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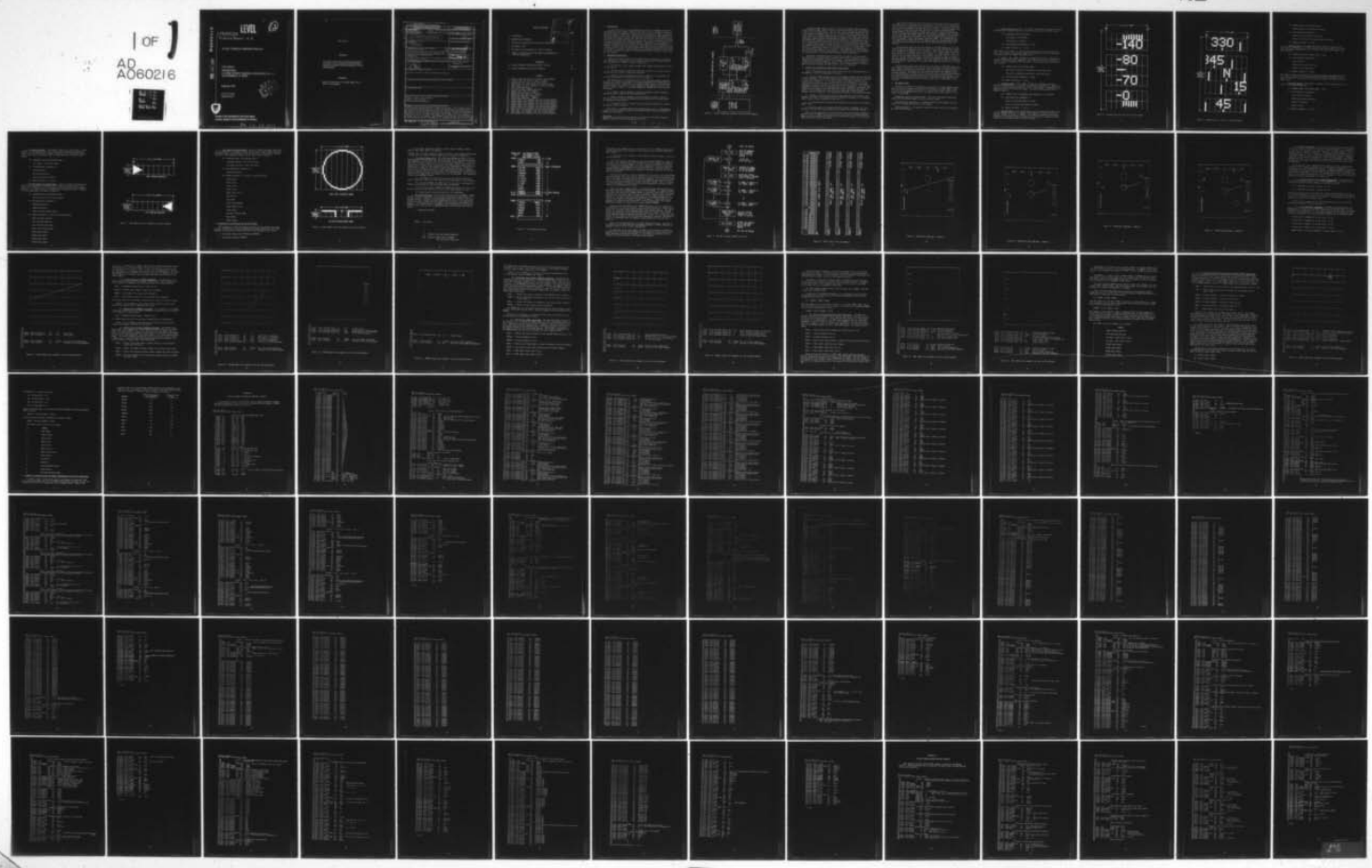

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Technical Report - 78-43

DIGITAL SYMBOLOGY GENERATOR PROGRAM

Tunis Robbins

HEADQUARTERS
U S ARMY AVIONICS RESEARCH & DEVELOPMENT ACTIVITY
FORT MONMOUTH, N J 07703

September 1978

Research and Development Technical Report
Aviation Research and Development Command

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

A digital symbology generator program is described. This program, written for an SKC-2000 Airborne Computer, is the software portion of an airborne Digital Symbology Generator (DSG) developed by the Avionics Research and Development Activity for use in simulation and flight test programs. The DSG is capable of displaying a variety of command and flight control symbols in a raster format on a standard 525 line TV monitor. The displayed output provides 256 by 256 pixels (picture elements) and can be updated at the standard TV frame rate of 30 sec.

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1. INTRODUCTION

A large percentage of the simulation and flight test programs conducted by the Advanced Avionic Systems Technical Area have a need to display a variety of different types of command and flight control information to a pilot to assist him in performing a task (e.g., hovering or nap-of-the-earth (NOE) maneuvering). To satisfy this need, a project was undertaken to develop, for R&D purposes, a TV display which would provide the reliability and ease of set-up that is necessary for an airborne device and, at the same time, allow for adequate flexibility to quickly reconfigure the displayed symbols. The purpose of this report is to provide documentation for the Digital Symbology Generator (DSG) program, the software portion of this display system. This report is not intended to provide a detailed insight into the various algorithms used to generate each symbol, but is intended to provide an understanding of the program's capability and to serve as a guide to enable the reader to understand what must be done to operate and use the program.

2. BACKGROUND AND APPROACH

Earlier TV displays used by the Technical Area for simulation and flight test experiments have been of the all analog type and have suffered from several disadvantages. The most serious of these are:

a. The addition of new symbols require that hardware modification be made to the display.

b. Displays used for laboratory simulation studies are not easily incorporated into the follow-on flight test programs.

c. Numerous trim pot adjustments (such as, symbol size, centering, and scaling) are generally necessary for the initial set-up.

The acquisition by the Technical Area of two SKC-2000 airborne computers has made it possible to consider an all-digital approach in the development of an R&D display which would possess the characteristics needed for both simulation and flight test studies. A block diagram of the approach which has been taken is shown in Figure 1. The block diagram is divided into three sections as follows:

a. A digital computer program to generate symbology (Digital Symbology Generator) within a 256 by 256 bit binary matrix.

b. Special purpose TV/Computer interface (Digital-to-Video Converter-DVC) electronics to convert the digitally stored 256 by 256 bit binary array to composite TV video signal.

c. A standard 525 line TV monitor with conventional deflection circuitry and picture tube electronics.

This report is concerned mainly with subparagraph a above. Subparagraphs b and c above are covered in detail in Reference 1 and will be only briefly explained in this report.

[1] ECOM-4506, *"A Digital-to-Video Converter for Airborne Television Displays,"* Edward A. Karcher, Avionics Laboratory, July 1977.

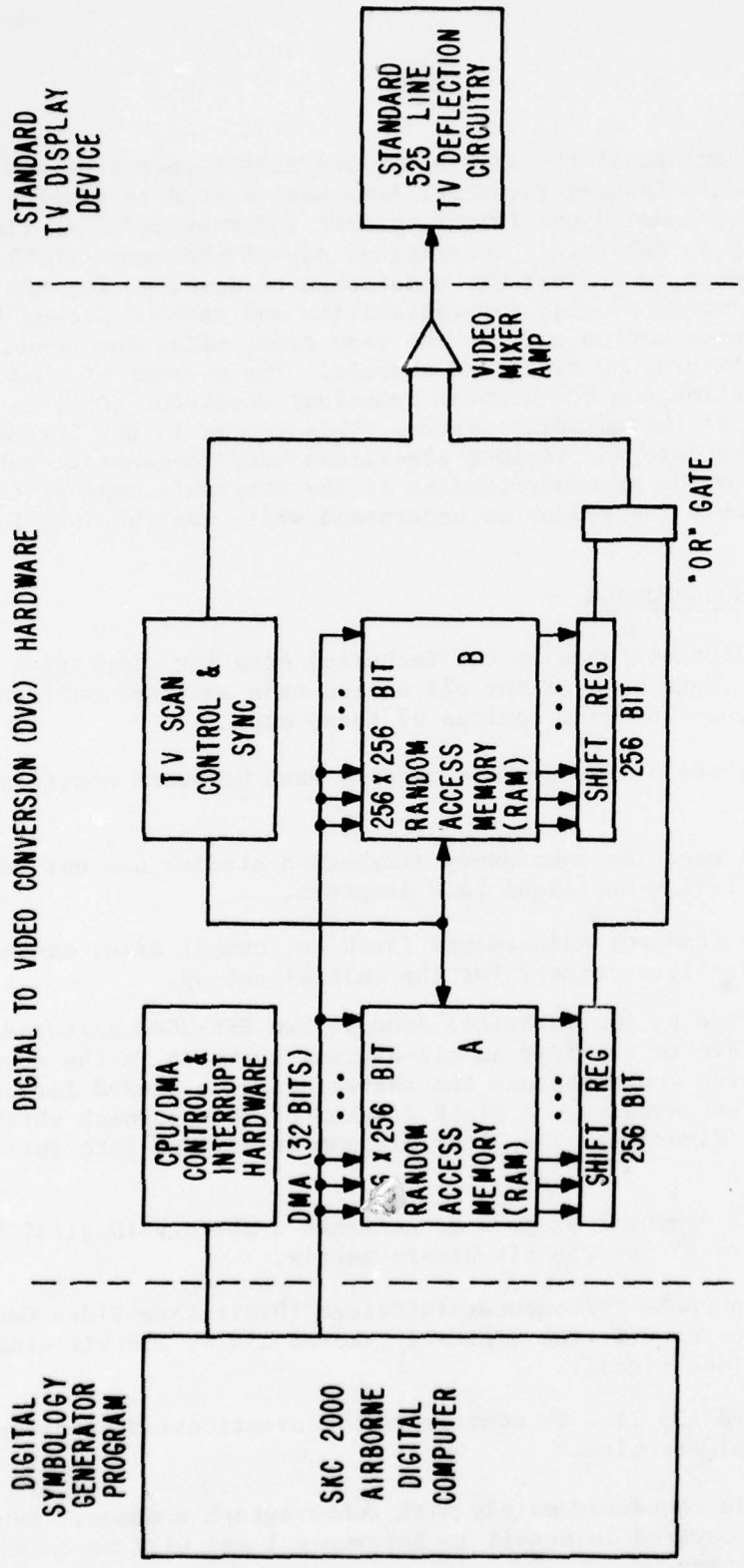


Figure 1. Digital symbology generator hardware block diagram

The DVC hardware shown in Figure 1, includes two semi-conductor random access memories (RAM), marked A and B in the block diagram, each representing a 256 by 256 bit binary matrix. The TV scan control and synchronization circuitry permits one memory (say, B) to be scanned at TV video rates while the other memory (A) is being asynchronously (i.e., not synchronized with the TV video scan rates) loaded through the direct memory access (DMA) with symbology previously generated within the SKC-2000 core memory. The scanning of B is accomplished by loading a full 256 bit line from B into a 256 bit shift register. This register is then shifted out serially at the horizontal scan rate of a standard TV through an OR gate where it is mixed with vertical and horizontal synchronization pulses to create a composite 2 level TV video signal. The B array is continually scanned on a line-by-line basis in this manner until the asynchronous loading of A is complete. Upon completion of the loading of A, and on the next vertical blanking pulse, a switchover occurs and A becomes the scanned matrix to be loaded with new data from the SKC-2000.

Using this "ping-pong" scheme of scanning one matrix at TV rates while the other matrix is being loaded, an update rate of the TV display can be accomplished at a maximum of 30 times per second. Although RAM's are being used in the scan conversion hardware, a true random access of the matrix must be accomplished sequentially through the DMA. This technique enables loading the RAM's with only a minimum CPU time required to set up the DMA.

3. INITIAL DSG INVESTIGATION AND PROGRAM ORGANIZATION

Some of the ground rules and program goals which were established for the development of the DSG program were as follows:

a. The DSG program should be written in assembly language for the SKC-2000 airborne computer. The SKC-2000 computer was developed by the Kearfott division of the Singer Company and is a 16K (32 bit/word) core memory machine with a floating point processor. Two of these machines were purchased - one for installation within the computer facility and one for installation in the EVAR (Experimental Vehicle for Avionics Research) flight test vehicle. The principal peripherals available for the airborne machine are two magnetic tape units, I/O typewriter with cassette mag tape read/write option, and paper tape punch and reader. The laboratory unit also has a card reader and an electrostatic printer/plotter in addition to the peripherals available on the airborne machine.

b. A family of symbol types should be developed that would include, as a minimum, the symbol set available on the all-analog TV displays (i.e., straight lines, vectors, boxes, crosses, circles, etc.).

c. The program should facilitate quick addition or deletion of the various symbol types.

d. Execution time of the program should be held to a minimum. As a program goal, the execution time should not be greater than 10-20 milliseconds.

Early in the investigation it became obvious that the program organization and the choice of symbol types would be greatly influenced by several factors. Some of the more significant factors and the particular aspects of the DSG that they affected will now be discussed.

The choice of symbol set was affected by the fact that the array in which the symbols would be generated was rectangular. This meant that, computationally, it would be simpler and also require less execution time to perform operations that are rectangular rather than polar in nature. For this reason, symbols such as lines and vectors that are free to rotate, and geometrically shaped symbols that are free to change size, should be kept to a minimum so as not to extend the program execution time beyond a tolerable limit. Because the attitude line and vector symbols are such familiar symbols on flight displays, both symbols are included in the selected symbol set (listed later), and, as expected, require the longest execution times. It is estimated that 75 percent of the coding time for the DSG was spent in developing fast execution algorithms that would allow the rotation and translation of these two symbols.

A factor which affected the total amount of SKC-2000 memory that the DSG required was the necessity to store the entire 256 by 256 bit (2048 full words) array in memory for generation of the symbols. This need to store the entire array rather than a smaller array, such as that for a single raster line, came about because of constraints by the DVC hardware. A raster line by raster line approach for the symbol generation would greatly extend the total execution time for the DSG, since each symbol could not be computed through to completion taking advantage of symbol symmetry. Also, the inability to "OR" and clear the DVC array made it impractical to transfer each symbol to the DVC as it is being generated.

Another factor which also affected the total amount of SKC-2000 memory required was the decision to store tables of trig functions for fast access rather than compute the functions through the library subroutine at execution time. This decision was made simply to reduce execution time at the expense of additional storage. A decision of this type is typical of the trade-off that must be continually made to reduce execution time in a time critical program. For this case, approximately 1,000 full words of additional storage was sacrificed to gain an estimated fifteen-fold increase in the speed of computing a trig function.

4. THE SYMBOL TYPES

Based on the intial DSG investigation, as well as the anticipated requirements of future laboratory and flight test experiments, several symbol types were selected for generation by the DSG. Each of these symbol types is discussed in the paragraphs that follow. The discussion of each symbol will include the following:

Commanded inputs and maximum range -- the real time symbol positioning command and the maximum range of variation of the symbol.

Reconfiguration parameters -- parameters which can be changed, but will normally be changed under non-real time control.

Number available -- the number of symbols of each type that is available for real time selection.

a. Artificial Horizon Line. This symbol consists of a sequence of points, approximating a straight line, that extends across the 256 by 256 bit array.

(1) Commanded inputs and range --

Roll angle, $\pm \pi/2$ radians

Pitch angle, $\pm$ 1 radian

(2) Reconfiguration parameters -- none

(3) Number available -- 1 each

This symbol will normally be used in conjunction with an attitude reference mark. An attitude reference mark symbol is included as one of the two degree-of-freedom fixed size symbols described later.

b. Vector. This symbol consists of a sequence of points representing a straight line segment which connects a base point and end point. The vector can be positioned anywhere within the array. Both the base and end point are free to move.

(1) Command inputs and maximum range --

Base point rectangular coordinates, total array area.

End point rectangular coordinates, total array area.

(2) Reconfiguration parameter -- range

(3) Number available -- 1 each

c. Airspeed Symbol. This symbol consists of a reference mark and a vertically movable scale or tape that is graduated and numbered to enable display of aircraft airspeed to within $\pm$ 1 knot. This symbol is generated by displaying a portion of a stored dot array. A portion of this stored array is shown in Figure 2.

(1) Command input and maximum range airspeed, 0 to 140 knots.

(2) Reconfiguration paramaters --

Amount of the scale that is visible

Location of the scale within the raster

(3) Number available -- 1 each

d. Heading Symbol. This symbol consists of a reference mark and a horizontally movable scale that is graduated and numbered to enable display of aircraft heading to within $\pm$ 1 degree. This symbol is generated in a manner similar to the airspeed symbol by displaying a portion of a stored dot array. A portion of the heading tape is shown in Figure 3.

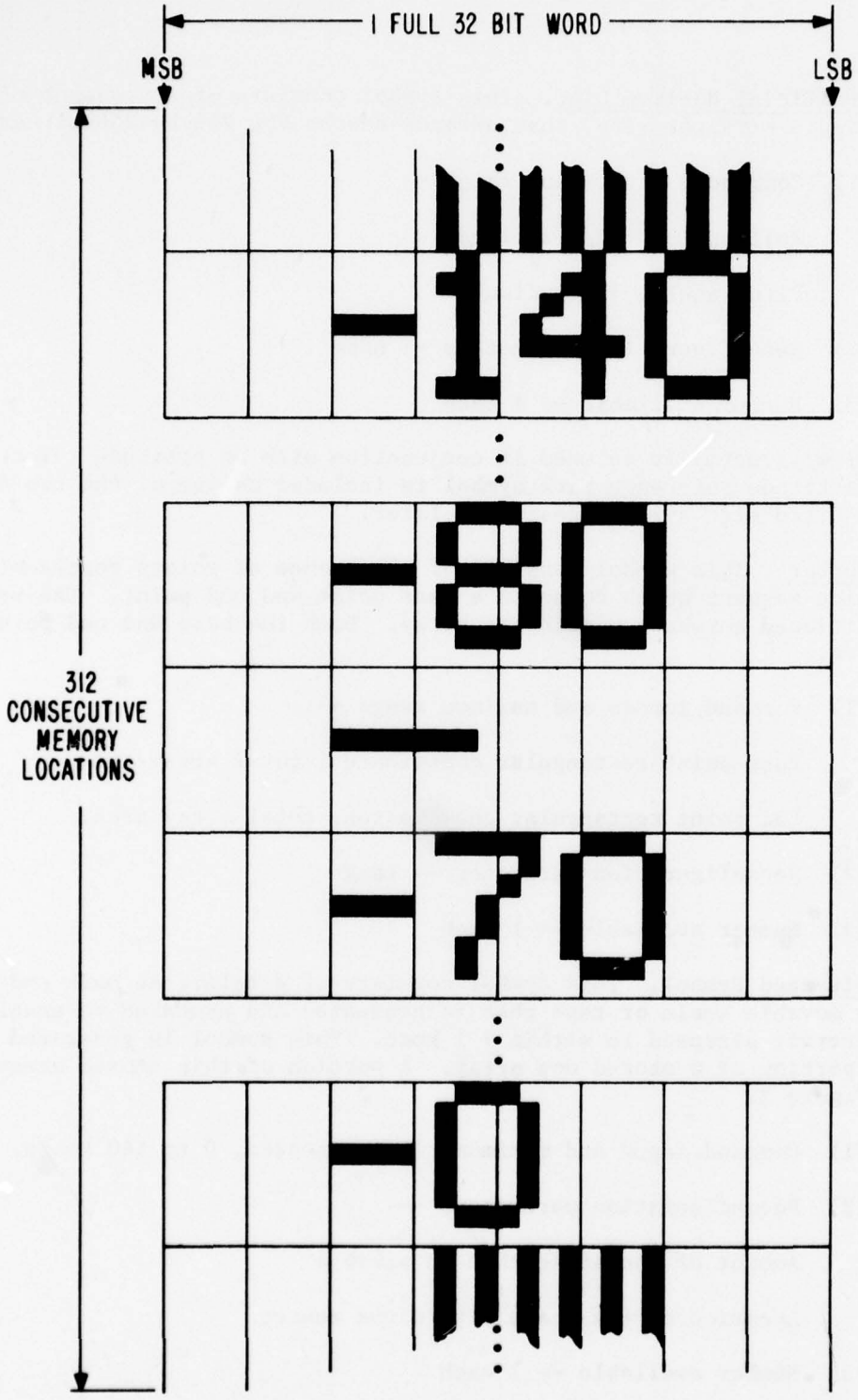


Figure 2. Airspeed tape dot array as stored in memory

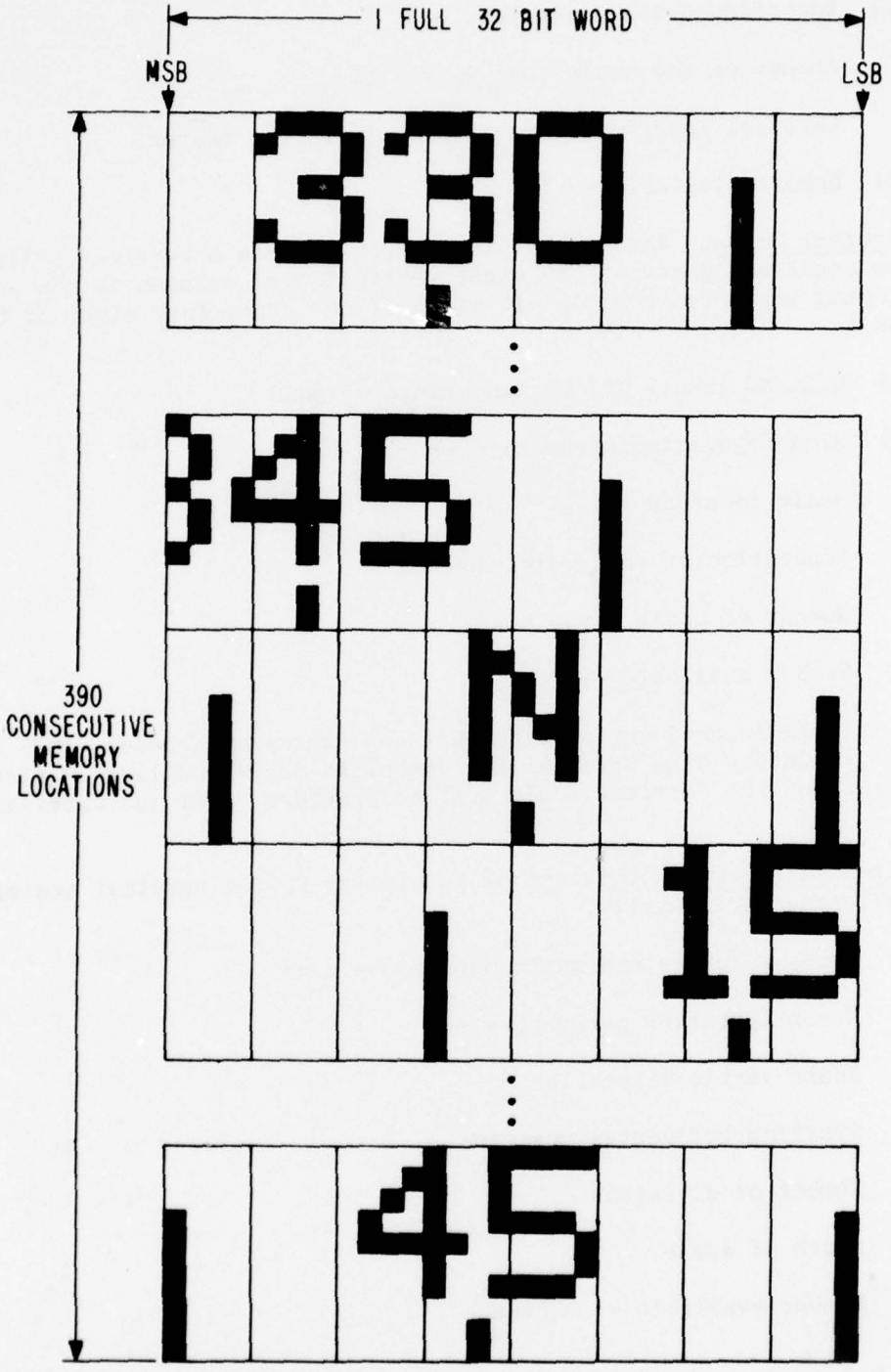


Figure 3. Heading tape dot array as stored in memory

(1) Command inputs and maximum range --

Heading angle, ± 360 degrees continuous

(2) Reconfiguration parameters --

Amount of the scale that is visible

Vertical location of the scale within the raster.

(3) Number available -- 1 each

e. Vertical Scale. This symbol is used to provide a vertical scale which can be centered on any of the eight vertical word columns in the array. (The DSG program separates the 256 bit width of the array into eight 32 bit word columns.)

(1) Command inputs and maximum range -- none

(2) Reconfiguration parameters --

Scale location

Separation of scale divisions

Number of scale divisions

(3) Number available -- 2 each

This symbol is used in conjunction with vertical degree-of-freedom (DOF) symbols, such as, pointers or a vertical bar symbol as described later. Also, reference marks for the vertical scale must be provided from the vertical DOF symbol type.

f. Horizontal Scales. This symbol is similar to the vertical scale, except it is oriented horizontally.

(1) Command inputs and maximum range -- none

(2) Reconfiguration parameters --

Scale vertical location

Starting horizontal position

Number of divisions

Width of scale

(3) Number available -- 2 each

g. Vertical Bar Symbol. This symbol consists of a narrow bar or ribbon similar to a thermometer which can be controlled to extend or shorten its length in either a positive or negative direction from a specified reference point. This symbol is normally used in conjunction with a vertical scale symbol.

(1) Commanded inputs and maximum range --

Bar length, total array length

(2) Reconfiguration parameters --

Bar sensitivity

Horizontal position

Upper and lower bar limits

(3) Number available -- 2 each

h. Vertical Degree-of-Freedom Symbol. This is a fixed size symbol type which can be controlled to translate in the vertical direction only. This symbol can be located in any of the eight selectable vertical word columns in the array. The symbol's shape is determined by a stored dot array. Examples of these stored arrays are shown in Figure 4.

(1) Commanded inputs and maximum range --

Vertical position, total array height

(2) Reconfiguration parameters --

Horizontal position

Symbol sensitivity

Upper and Lower symbol limits.

(3) Number available -- 8 each, as specified below

Right pointing indicator

Left pointing indicator

Left side reference mark

Right side reference mark

CRUISE alpha symbol

TRANS alpha symbol

HOVER alpha symbol

BOB-UP alpha symbol

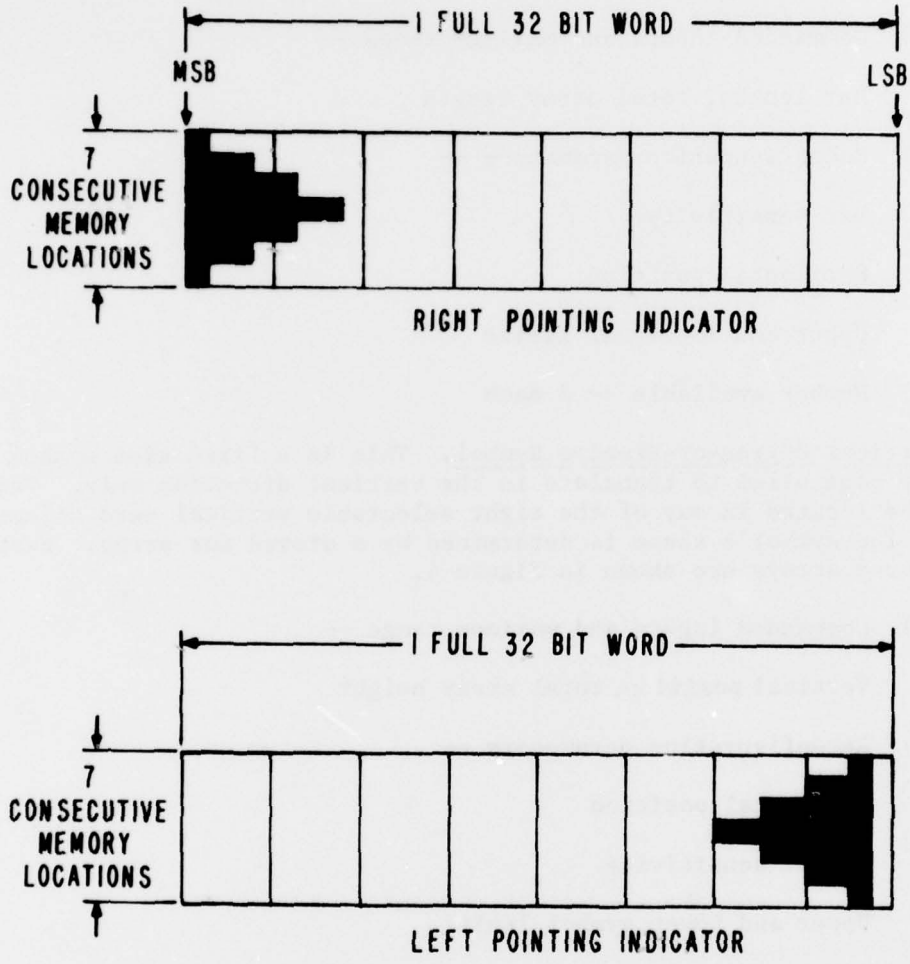


Figure 4. VDOF symbol dot array example as stored in memory

i. Two Degree-of-Freedom Symbol. This is a fixed size symbol type which can be controlled to translate in both the vertical and horizontal directions. The symbol shape is determined by a stored dot array. These symbols normally consist of simple geometric shapes such as those shown in Figure 5.

(1) Commanded inputs and maximum range --

Vertical position, total array height

Horizontal position, total array width

(2) Reconfiguration parameters --

Symbol sensitivity

(3) Number available -- 13 each, as specified below

Large cross

Small cross

Large circle

Small circle

Small solid circle

Down pointer

Up pointer

Small solid diamond

Large broken circle

Large square

Attitude reference mark

Male symbol

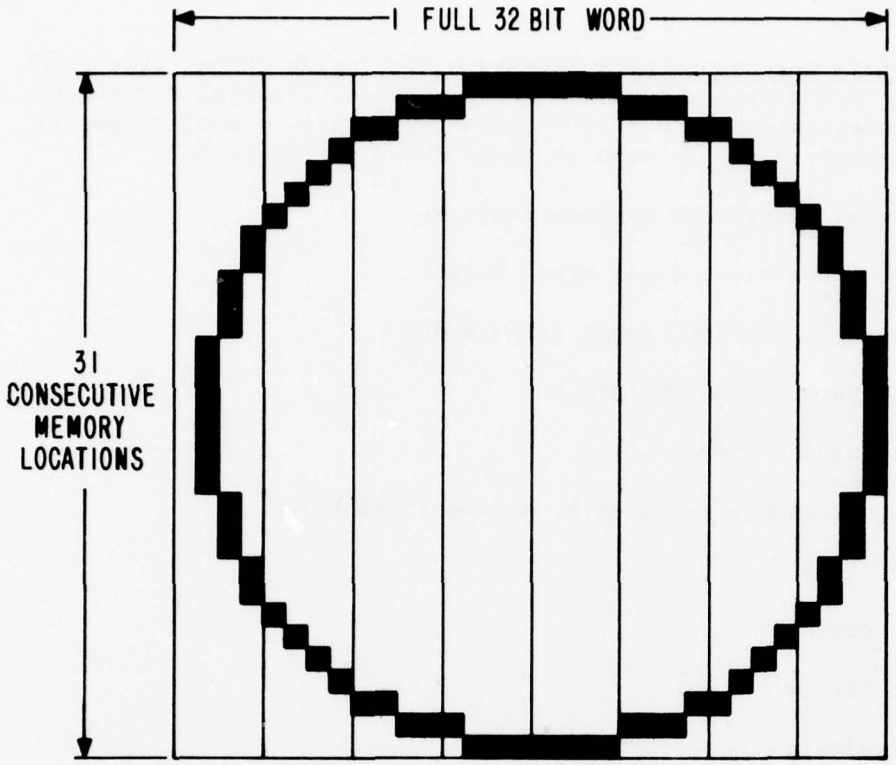
Female symbol

5. DISCUSSION OF THE OPERATION OF THE DSG PROGRAM

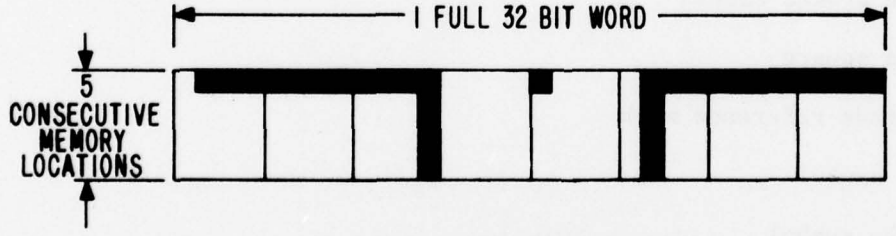
The explanation of the DSG program operation will be divided into three sections in which each section corresponds to a major subdivision of the DSG program. The three major subdivisions of the DSG program are as follows:

a. The common storage area (LSICMN and CORECMN)

b. The DSG main program (SYMGEN)



LARGE CIRCLE (FIXED SIZE) SYMBOL



ATTITUDE REFERENCE MARK SYMBOL

Figure 5. XYDOF symbol dot array example as stored in memory

c. The symbol subprograms (ATLINE, VECTOR, AIRSPD, COMPASS, VSCALE, HSCALE, VBAR, VDOF, XYDOF, and DRDOUT).

A memory map of the DSG program is shown in Figure 6. The complete DSG program listings and the assembly language mnemonics are included in Appendix A.

a. The Common Storage Area. The LSICMN and CORECMN sections of the program are memory storage areas that can be accessed by all DSG program routines. The LSICMN area is located in the fast RAM (random access memory) - a 256 full word area of volatile memory with a .5 μs cycle time. Because the contents of this section of memory would be destroyed if the machine was powered down, the LSICMN area is used only for storage of temporary information. A total of 10 full words of storage is set aside for use as temporary storage of argument lists as they are transferred into a subprogram and 5 full words of storage are used as a general-purpose scratch-pad area. The CORECMN area is located in the slower (1.0 μs cycle time) core memory section of the SKC-2000. The information stored in the CORECMN includes:

(1) The TVRSTR (the 256 by 256 bit array that requires 2048 full words) in which all symbols are generated before being output to the TV display.

(2) Bit masks (BMSKØ and BMSKI) used by the symbol subprograms for "OR"ing in individual bit patterns during symbol generation.

(3) Trig table arrays (COSTBL and TANTBL each require 514 full words) for the storage of trig functions for fast access during execution time.

(4) Miscellaneous constants required by the subprograms.

b. The DSG Main Program. The DSG main program is called SYMGEN. SYMGEN has been written in subroutine form and must be called by a master main (or calling) program. Normally, the master main program will provide a real time clocked interrupt routine from which SYMGEN will be called. The calling program must provide a symbol select argument (described later) and symbol drive command to the SYMGEN program. The symbol select argument must be placed immediately after the call to the SYMGEN subroutine in the master main code as follows:

```
*   MASTER MAIN PROGRAM
.         .
.         .
.         .
SYMGEN    SETX  Ø7152
.         .
.         .
.         .
          JS    SYMGEN * CALL THE SYMGEN SUBROUTINE
          HEX   nnnnnnn* SYMBOL SELECT ARGUMENT
           .               *8 hexadeciman characters)
           .
           .
```

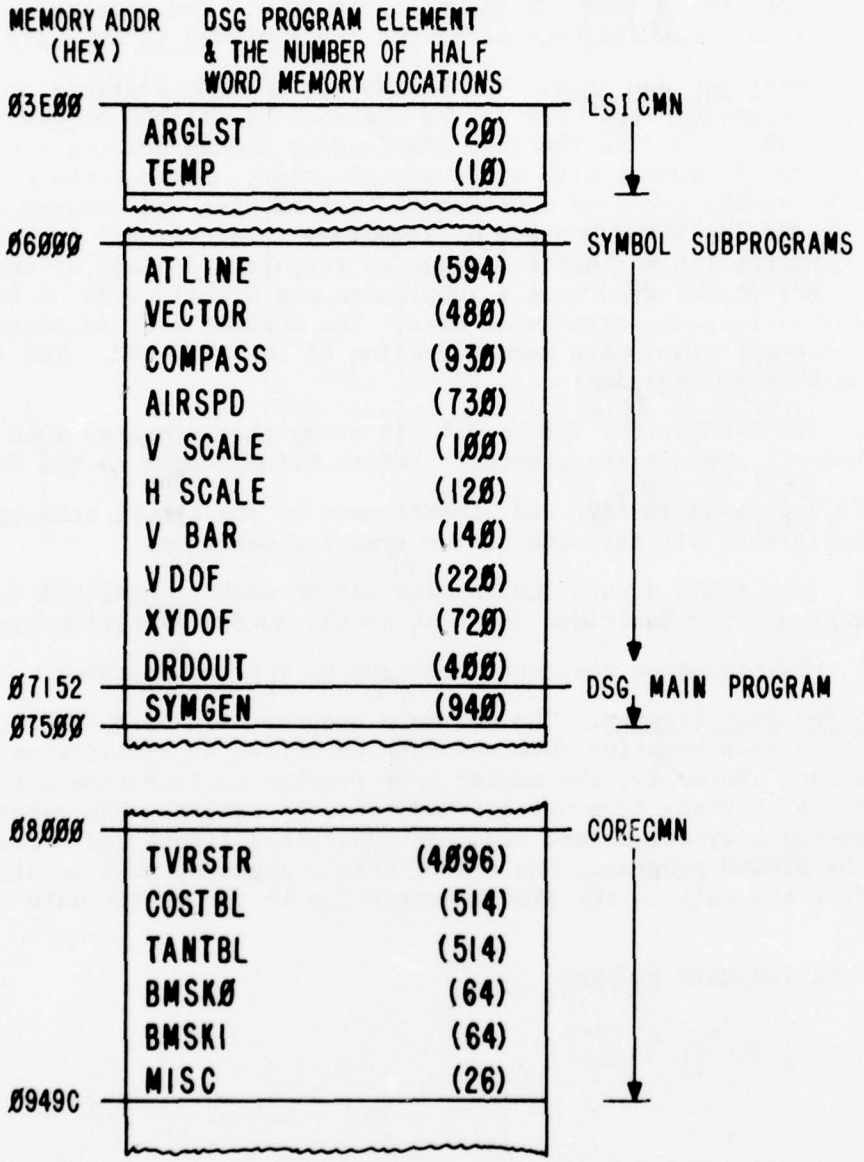


Figure 6. DSG program memory map

The symbol drive commands must be stored directly in the SYMGEN program by the master main program or by another routine which is also called by the master main program.

A flow chart of the operation of the SYMGEN is given in Figure 7, and will now be discussed.

The first operation performed on each pass through SYMGEN is to save the contents of all program and index registers that will be changed by SYMGEN or any subroutine called by SYMGEN. The final operation performed on each pass is to restore the original contents of these registers. These two operations are performed to allow SYMGEN to be called as part of an interrupt routine without having SYMGEN destroy the contents of registers needed by the routine being interrupted.

The next operation is a test to determine if this is the first time SYMGEN has been called. If it is, then the tables of trig functions are generated for use by the symbol subroutines during subsequent passes. If the calling program uses a real time clock interrupt routine, the SYMGEN program should be called at least once before enabling the clocked interrupt routine. This is necessary since the generation of the trig tables takes approximately 150 ms and could overrun the clocked interrupt frame.

Next, the symbol select argument is transferred from the master main program and stored in the SYMGEN in a location called SYMSEL. The SYMSEL argument is a coded word used by the SYMGEN program to determine which symbols are to be generated for the current pass through the program. Figure 8 shows the SYMSEL word and the particular symbol type that each of the 32 bit position corresponds to. The table also shows four examples of the SYMSEL hexadecimal code for the four symbol sets shown in Figures 9 through 12. These figures were generated by outputting the TVRSTR onto a Varian Electrostatic line printer. Appendix B contains a listing of this output program (PRNTSM).

Continuing the discussion of the SYMGEN flow chart, the next operation to be performed is to clear the TVRSTR. This operation removes all symbols generated on the previous pass before generating the updated symbols. This operation is not required, if the hardware clear option is selected when the DMA (direct memory access) output is initiated later in the frame. This option, a recent SKC-2000 interface hardware modification, results in a considerable time savings (on the order of 4 ms) on each pass through the program. The hardware clear is accomplished while the TVRSTR is being outputted to the DVC (see Figure 1).

After the clearing operation, the symbol generation begins. Each bit in the SYMSEL word is tested and the corresponding symbol is either generated or skipped if the bit is "1" or "0," respectively.

On completion of the last symbol, the DMA is initiated and the TVRSTR is transferred to the DVC to allow display of the symbols on the TV screen. The final operation, as mentioned earlier, is to restore all registers to their original contents and return to the master main program.

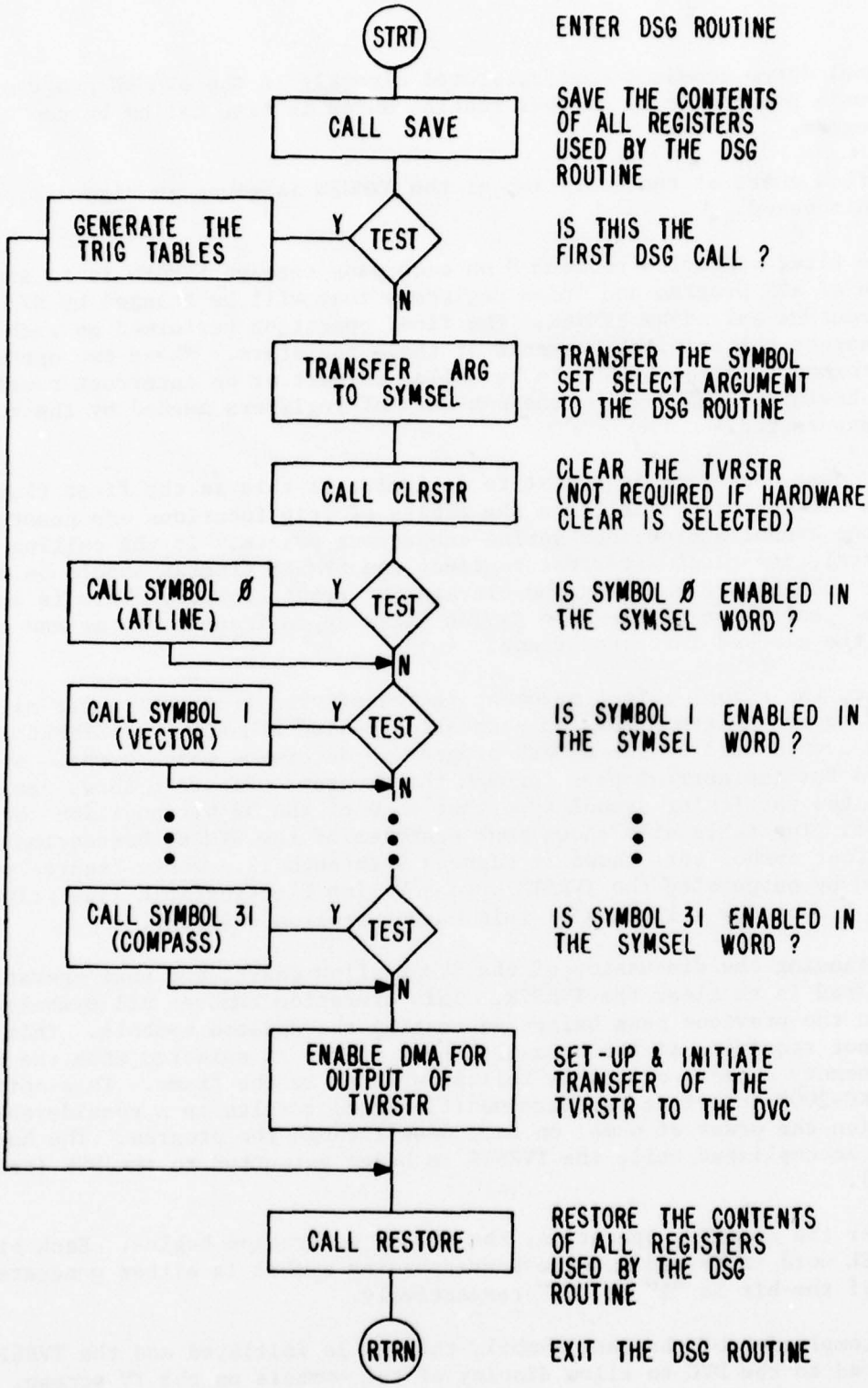


Figure 7. DSG main program (SYMGEN) flow chart

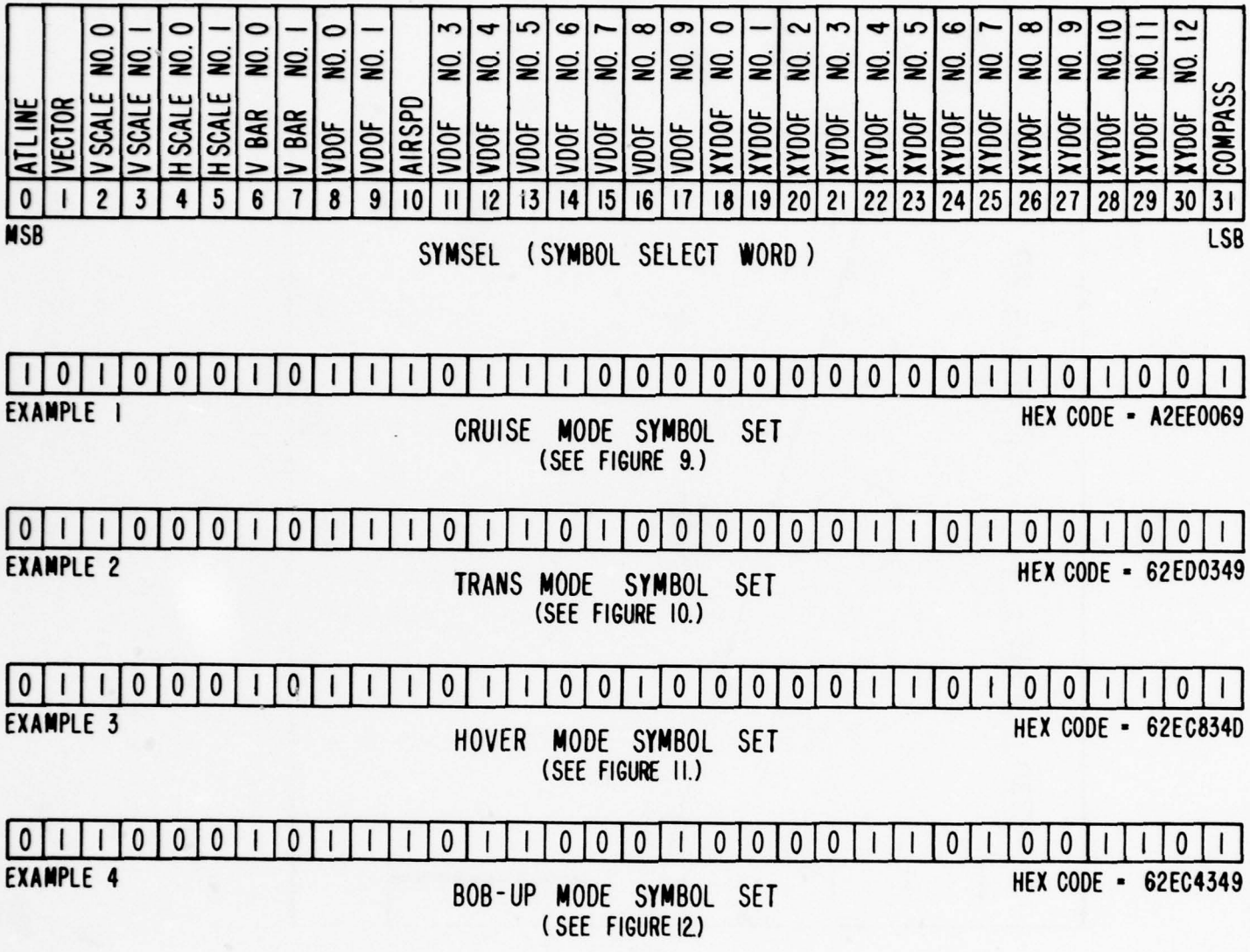


Figure 8. Symbol select code and examples

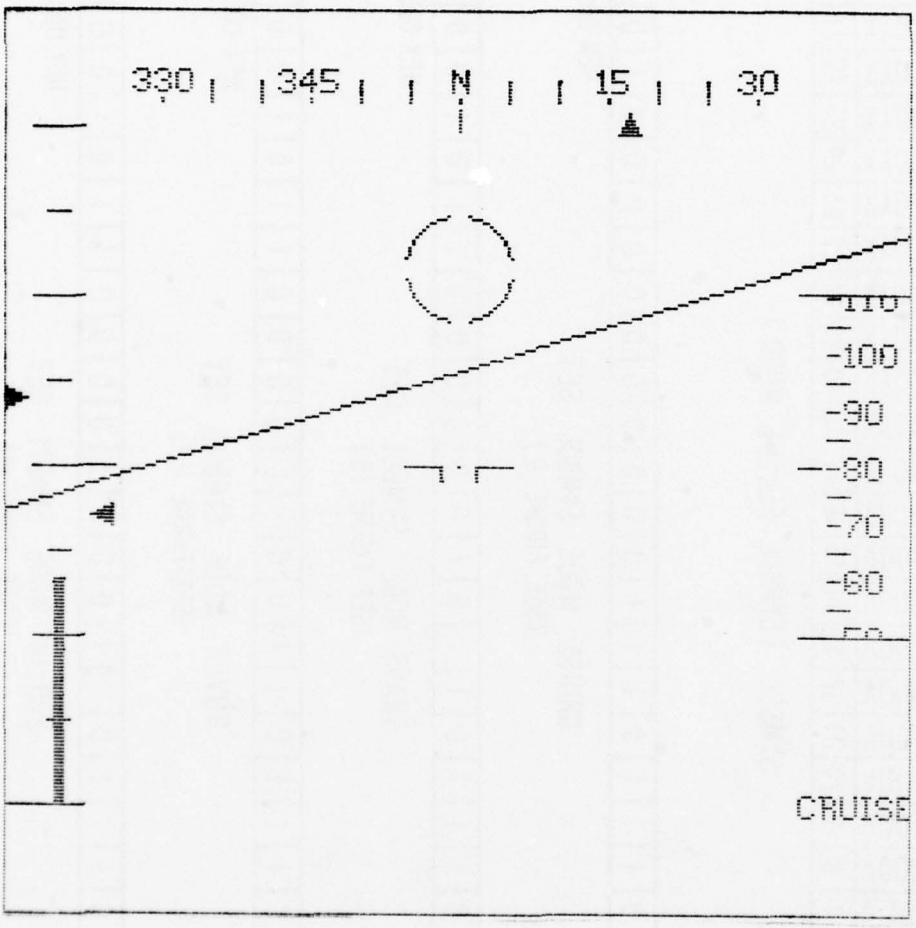


Figure 9. CRUISE mode symbology - example 1

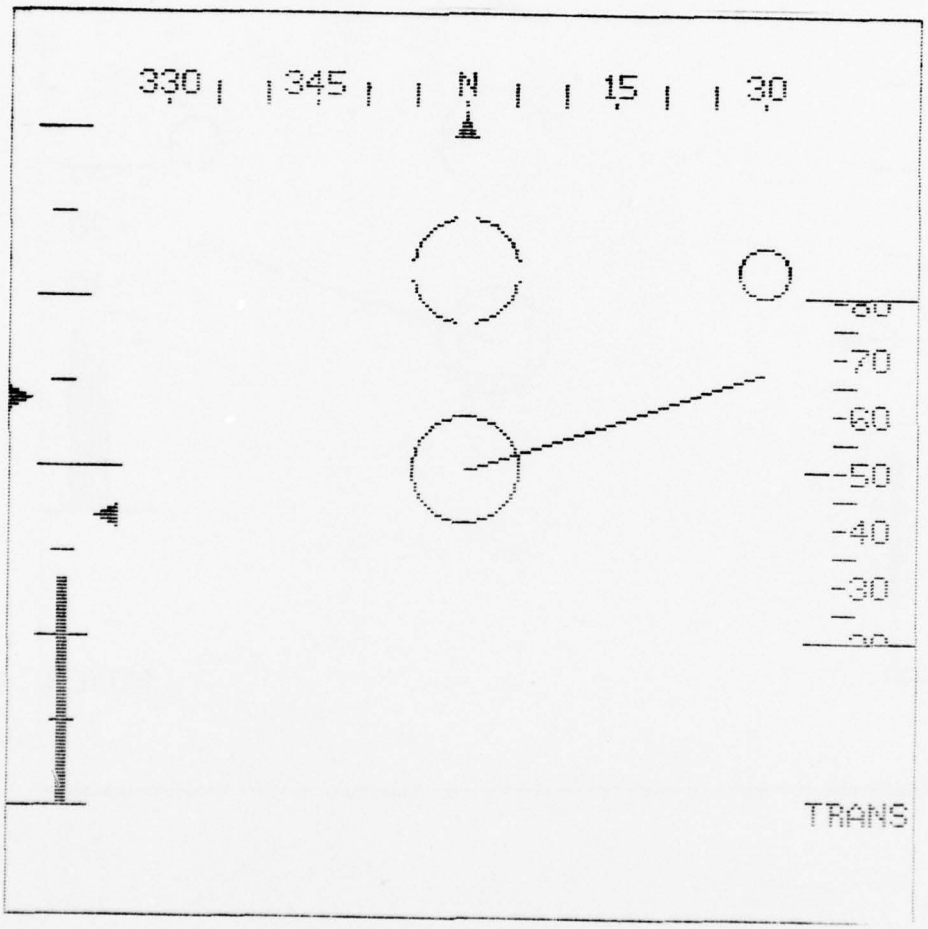


Figure 10. TRANSition mode symbology - example 2

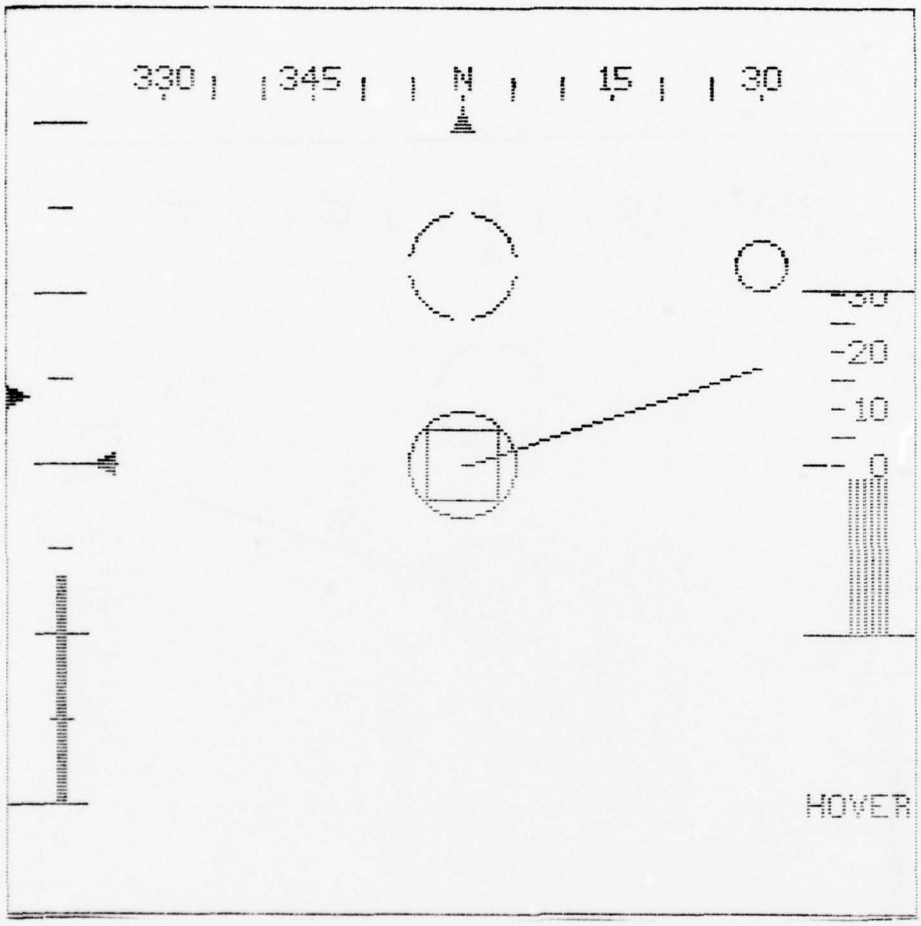


Figure 11. HOVER mode symbology - example 3

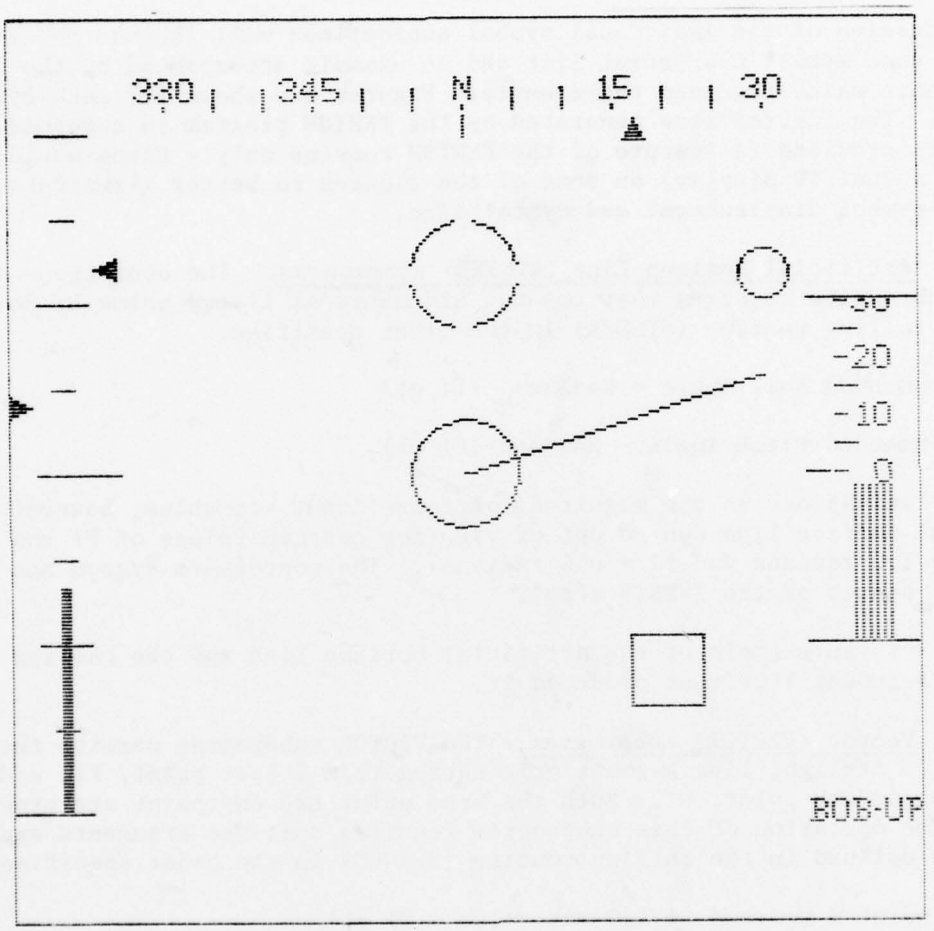


Figure 12. BOB-UP mode symbology - example 4

c. The Symbol Subprograms. Subroutines have been written to permit generation of each of the symbol types discussed in paragraph 4. It is possible to call the same subroutine more than once within the same frame if several of the same types of symbols are desired. However, a separate agrument list is required for each call of a subroutine. The SYMGEN puts some restrictions on the maximum number of times a particular subroutine can be called. Should a symbol set be desired that exceeds any of these maximum numbers, the SYMGEN program would have to be reassembled to permit the new maximums. The current maximums for each symbol type is given in the discussion of the symbol types in paragraph 4.

The discussion of the individual symbol subroutines will include an explanation of each symbol's argument list and an example accompanied by the calling sequence which produced the example. Figures are shown for each symbol type example. The figures were generated by the PRNTSM program in Appendix B. Grid lines are provided (a feature of the PRNTSM routine only - these would not appear on an actual TV display) on some of the figures to better illustrate the magnitude of symbol displacement and symbol size.

(1) Artificial Horizon Line (ATLINE) subprogram. The operations of the ATLINE subroutine requires that the two arguments as listed below be defined in the calling routine (SYMGEN) in the order specified.

FI -- Commanded Roll Angle - Radians (fl pt)

TH -- Commanded Pitch Angle - Radians (fl pt)

There are no limitations on the magnitude of these input variables; however, the artificial horizon line can go out of view for certain values of FI and TH (e.g., TH = $\pm$ 1.0 radians and FI = 0.0 radians). The coordinate system has its origin at the center of the TVRSTR array.

Figure 13 is an example of the artificial horizon line and the calling sequence and argument list that produced it.

(2) Vector (VECTOR) subprogram. The VECTOR subprogram permits the generation of a straight line segment originating from a base point, P1, and terminating on an end point, P2. Both the base point and end point are program variables. The operation of this subprogram requires that the arguments specified below be defined in the calling routine (SYMGEN) in the order specified.

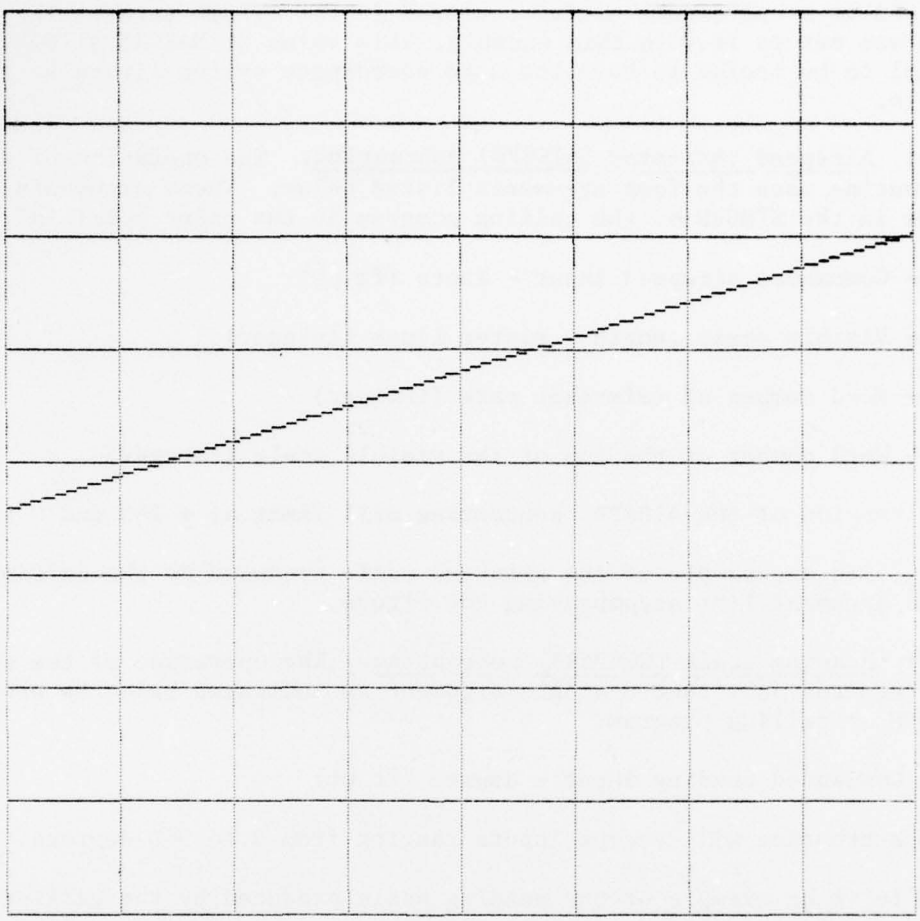
X1 Base point X Command ($\pm$ 1.0 max value - fl pt)

Y1 Base point Y Command ($\pm$ 1.0 max value - ft pt)

Y2 End point X Command ($\pm$ 1.0 max value - fl pt)

Y2 End point Y Command ($\pm$ 1.0 max value - fl pt)

MARGIN Width of the outer boundary (+ 128 max value - ft pt)



```
144                                .       .       .
145                                .       .       .
146                                .       .       .
147 0A002  40962 3FCCCCCC FI       DEC     0.3     ROLL ANGLE
148 0A004  40964 BF199999 TH       DEC     -0.2    PITCH ANGLE
149                                .       .       .
150                                .       .       .
151                                .       .       .
152 0A006  40966 64046000          JS      ATLINE  CALL THE ATLINE SUBROUTINE
153 0A008  40968 0400A002          PTR     FI      POINTER TO THE FIRST ARGUMENT
154                                .       .       .
155                                .       .       .
156                                .       .       .
```

Figure 13. ATLINE symbol with argument list and calling sequence

Figure 14 is an example of a VECTOR symbol and the associated calling sequence and argument list. For this example the base point P1 (X1, Y1) = 0.0, -0.5) and end point P2 (X2, Y2) = (+ 0.75, + 0.25). The VECTOR coordinate points are referenced to a coordinate system centered in the TVRSTR array. The argument MARGIN was set to 16.0 in this example. This value of MARGIN allows the VECTOR symbol to be scaled to have the same coordinate system limits as the XYDOF symbols.

(3) Airspeed indicator (AIRSPD) subroutine. The operation of the AIRSPD subroutine uses the four arguments listed below. These arguments must be set aside in the SYMGEN or the calling program in the order specified.

ASPD -- Commanded airspeed input - knots (ft pt)

SCLGTH -- Visible scale length - raster lines (integer)

RFMSKA -- Word number of reference mark (integer)

SCLSA -- Word number of the top of the visible scale (integer)

The current version of the AIRSPD subroutine will limit at $\pm$ 140 and 0 knots.

Figure 15 is an example of the airspeed scale produced by the calling sequence and argument list accompanying the figure.

(4) Heading scale (COMPASS) subroutine. The operation of the COMPASS subroutine requires only that a single argument as indicated below be provided in the SYMGEN or calling program.

HDG -- Commanded heading input - degree (ft pt)

The COMPASS subroutine will accept inputs ranging from 0 to 360 degrees.

Figure 16 is an example of the heading scale produced by the calling sequence and argument included with the figure.

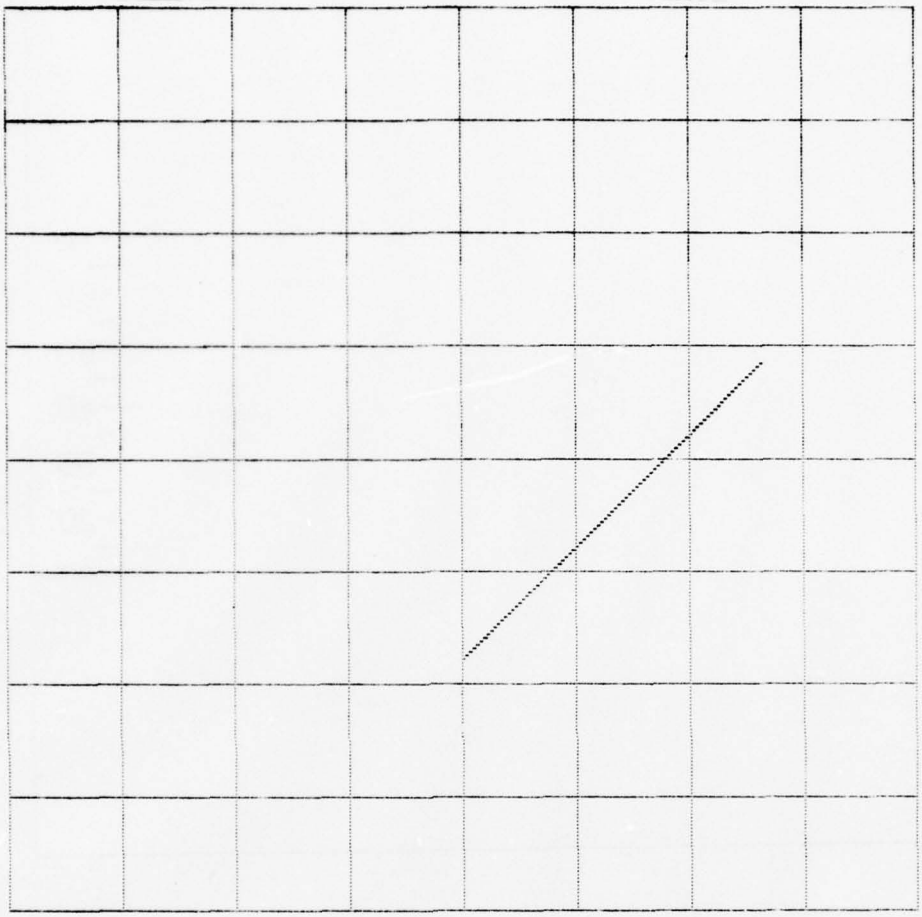
(5) Vertical Scale (Fixed) (VSCALE) subprogram. The VSCALE subprogram allows for the generation of fixed vertical scales located in any of the eight raster word columns. The set-up and location of this symbol type requires that the subroutine arguments as defined below be pre-set in the SYMGEN routine in the order specified. The suffix, small n, is a scale identification number. The present SYMGEN configuration allows two vertical scales in which n equals 0 or 1. Scale pointers and reference marks must be provided by the vertical degree-of-freedom (VDOF) symbol subprogram.

HPOSn -- Raster word column number (integer format) of the horizontal position of the scale.

VSCLCn -- Raster line number (integer format) of the scale center mark.

VSPCn -- Raster line spacing (integer format) between two scale divisions.

VMRKSn -- The total number of scale divisions (integer format), excluding the scale center.

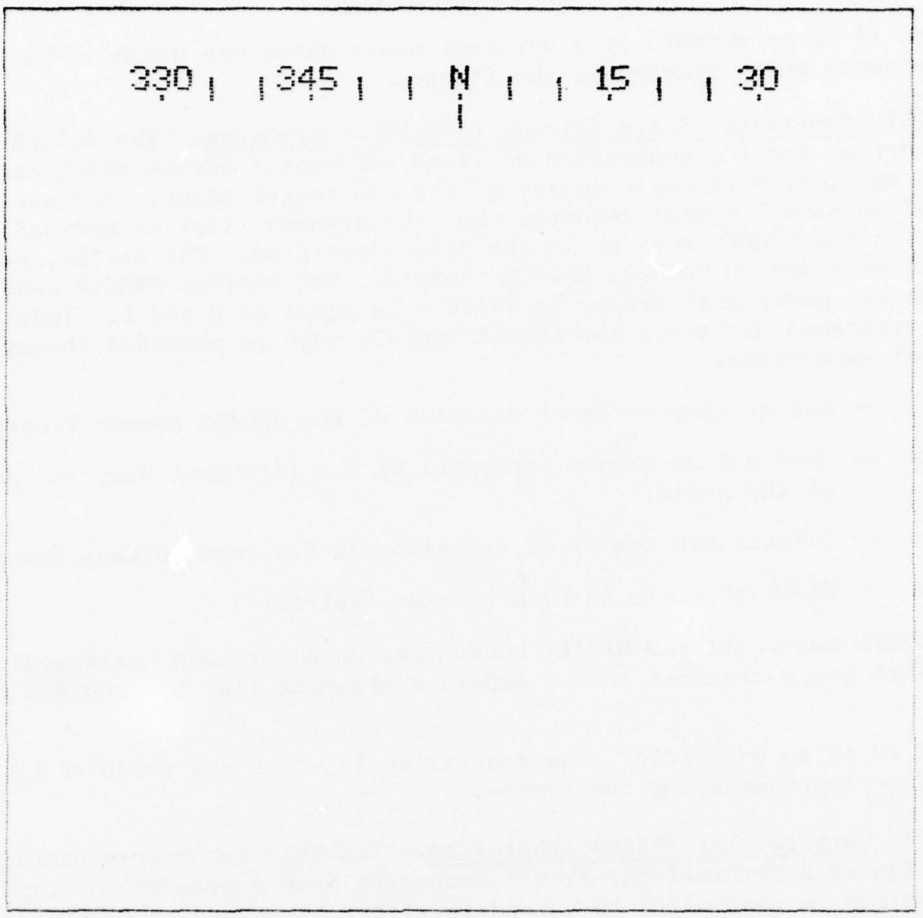


```
162                                 .       .       .
163                                 .       .       .
164                                 .       .       .
165 0A014   40980 00000000 X1       DEC     0.0     BASE POINT X COORDINATE
166 0A016   40982 BF800000 Y1       DEC     -0.5    BASE POINT Y COORDINATE
167 0A018   40984 40600000 X2       DEC     0.75    END POINT X COORDINATE
168 0A01A   40986 3FC00000 Y2       DEC     0.25    END POINT Y COORDINATE
169 0A01C   40988 42C00000 MARGIN   DEC     16.0    WIDTH OF THE OUTER BOUNDARY
170                                 .       .       .
171                                 .       .       .
172                                 .       .       .
173 0A01E   40990 64046252         JS      VECTOR  CALL THE VECTOR SUBROUTINE
174 0A020   40992 0400A014         PTR     X1      POINTER TO THE FIRST ARGUMENT
175                                 .       .       .
176                                 .       .       .
177                                 .       .       .
```

Figure 14. VECTOR symbol with argument list and calling sequence


```
184                                .          .          .
185                                .          .          .
186 0A02C   41004 43500000 ASPD    DEC        40.0       AIRSPEED INPUT
187 0A02E   41006 00000061 SCLGTH  DEC        97         SCALE LENGTH IN RASTER LINES
188 0A030   41008 0000080E RFMKSA  DEC        2062       REFERENCE MARK WORD LOCATION
189 0A032   41010 000004FE SCLSA   DEC        1278       SCALE STARTING ADDRESS
190                                .          .          .
191                                .          .          .
192                                .          .          .
193 0A034   41012 640467D4        JS         AIRSPD     CALL THE AIRSPD SUBROUTINE
194 0A036   41014 0400A02C        PTR        ASPD       POINTER TO THE FIRST ARGUMENT
195                                .          .          .
196                                .          .          .
197                                .          .          .
```

Figure 15. AIRSPD symbol with argument list and calling sequence




```
203
204                                  .     .     .
205                                  .     .     .
206 0A042  41026 00000000 HDG       DEC   0.0   .  HEADING INPUT
207                                  .     .     .
208                                  .     .     .
209                                  .     .     .
210 0A044  41028 64046432           JS    COMPASS  CALL THE COMPASS SUBROUTINE
211 0A046  41030 0400A042           PTR   HDG      POINTER TO THE SUBROUTINE ARGUMENT
212                                  .     .     .
213                                  .     .     .
214                                  .     .     .
```

Figure 16. COMPASS symbol with argument list and calling sequence

The SYMGEN calls the VSCALE subroutine once for each vertical scale that is desired on the display. For each vertical scale, a corresponding argument list must exist in the storage area of the SYMGEN.

Figure 17 is an example of a vertical scale which was produced by the calling sequence which accompanys the figure.

(6) Horizontal Scale (Fixed) (HSCALE) subprogram. The HSCALE subprogram provides for the generation of fixed horizontal scales which can be positioned vertically to begin on any of the 256 raster lines. The set-up and location of an HSCALE symbol requires that the argument list as defined below be pre-set in the SYMGEN routine in the order specified. The suffix, small n, permits differentiation between HSCALE symbols. The current SYMGEN configuration allows two horizontal scales in which n is equal to 0 and 1. Indicator marks and reference marks for the HSCALE symbols must be provided through the XYDOF symbol subroutine.

VPOSn -- Raster line vertical position of the HSCALE center (integer).

HSTRTn -- Word column number (integer) of the left most starting position of the scale.

HMSKn -- Selects the number of divisions in the word columns (integer).

HSIZEn -- Width of scale in word columns (integer).

The SYMGEN must call the HSCALE subroutine once for each horizontal scale desired. Each scale requires that a separate argument list be provided by the SYMGEN.

Figure 18 is an example of a horizontal scale which was produced by the calling sequence accompanying the figure.

(7) Vertical Bar (VBAR) subprogram. The VBAR subprogram provides for the generation of a vertical bar symbol emanating from a prescribed origin and whose length can be controlled to extend in either an upward or downward direction. The VBAR subroutine argument list, as defined below, must be pre-set in the SYMGEN routine in the order specified. The suffix, small n, is used to differentiate between two or more VBAR symbols. The present configuration of the SYMGEN permits two vertical bar symbols in which n equals 0 and 1.

YBARn -- Symbol input drive variable (f1 pt) maximum absolute valve - 1.Ø

KABARn -- Scaling parameter (f1 pt)

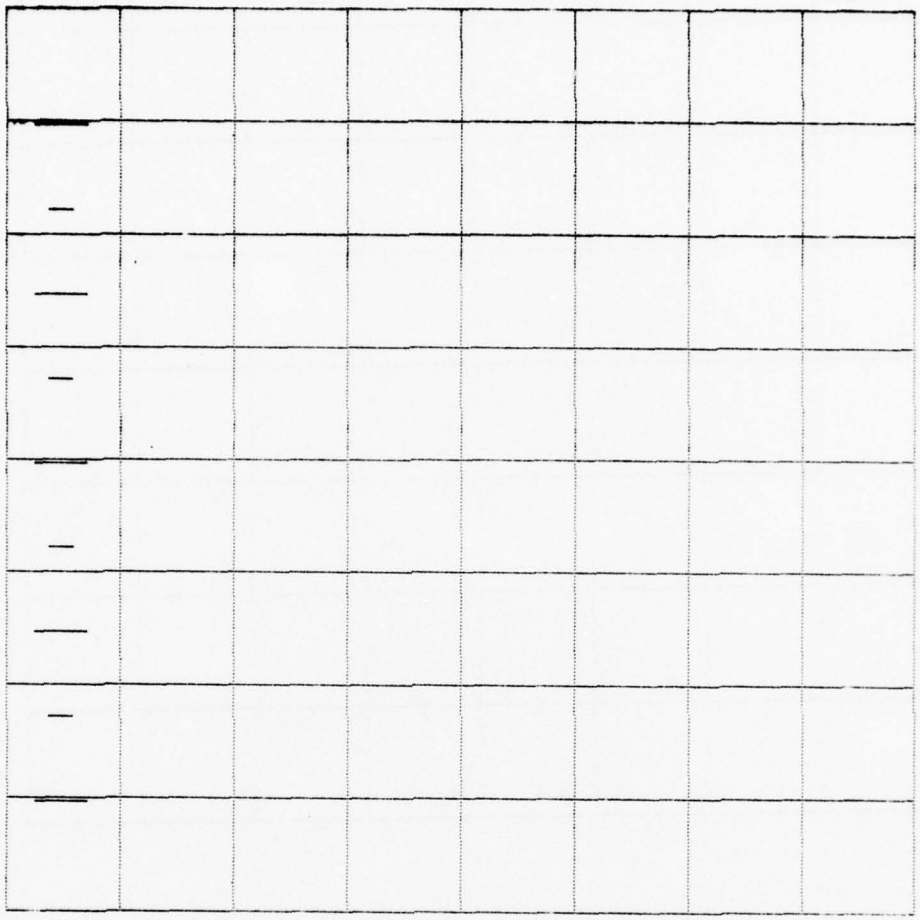
KBBARn -- Scaline parameter (f1 pt)

HPVBn -- Raster word column number of symbol horizontal position (integer)

BARSLn -- Bar position select code within the word column (integer)

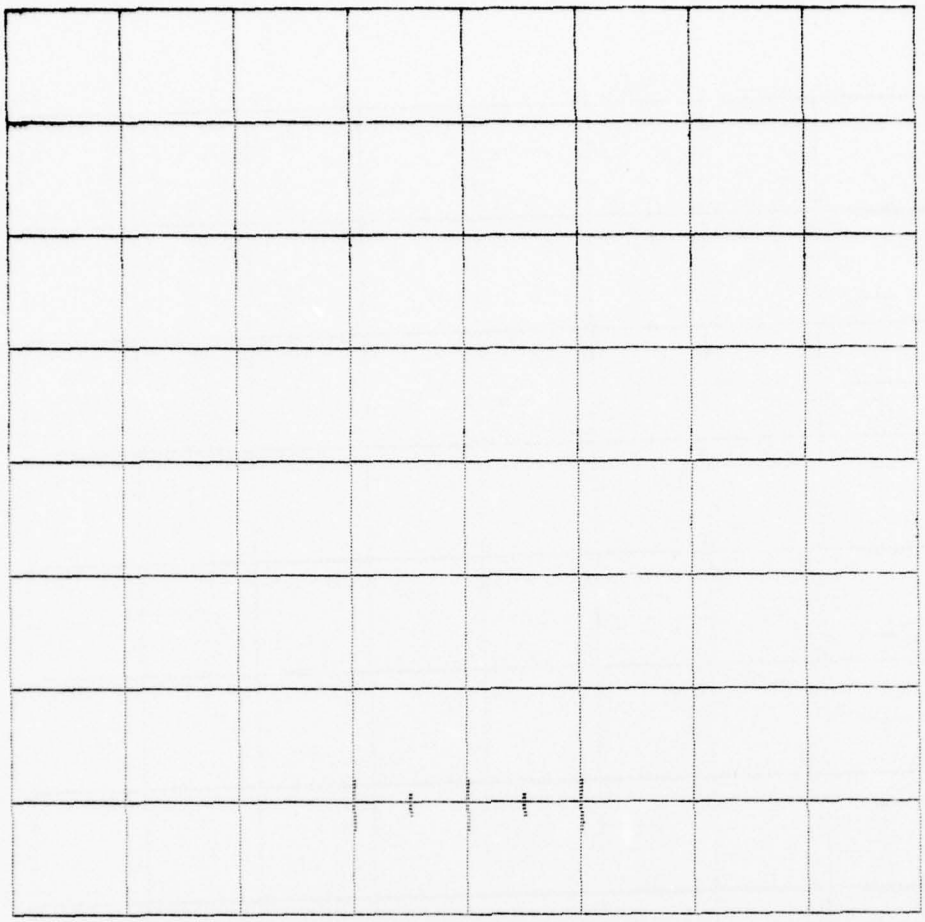
VBULn -- VBAR symbol upper limit (f1 pt)

VBLLn -- VBAR symbol lower limit (f1 pt)



```
220                                 .       .       .
221                                 .       .       .
222                                 .       .       .
223 0A052   41042 00000000 HPOS0    DEC     0       SCALE HORIZONTAL POSITION
224 0A054   41044 00000080 VSCLC0   DEC     128     RASTER LINE NO. OF THE SCALE CENTER
225 0A056   41046 00000018 VSPC0    DEC     24      VERTICAL SPACING OF SCALE MARKS
226 0A058   41048 00000008 VMRKS0   DEC     8       NO. OF SCALE MARKS
227                                 .       .       .
228                                 .       .       .
229                                 .       .       .
230 0A05A   41050 64046AAE          JS      VSCALE  CALL THE VSCALE SUBROUTINE
231 0A05C   41052 0400A052          PTR     HPOS0   POINTER TO THE FIRST ARGUMENT
232                                 .       .       .
233                                 .       .       .
234                                 .       .       .
```

Figure 17. VSCALE symbol with argument list and calling sequence



```
240                                 .       .       .
241                                 .       .       .
242                                 .       .       .
243 0A068   41064 000000E0 VPOS0    DEC     224     SCALE VERTICAL RASTER LINE POSITION
244 0A06A   41066 00000003 HSTRT0   DEC     3       SCALE STARTING WORD COLUMN NO.
245 0A06C   41068 00000002 HMSK0    DEC     2       NO. OF DIVISIONS/WORD COLUMN
246 0A06E   41070 00000002 HSIZE0   DEC     2       WIDTH OF SCALE IN WORD COLUMNS
247                                 .       .       .
248                                 .       .       .
249                                 .       .       .
250 0A070   41072 64046B12         JS      HSCALE  CALL THE HSCALE SUBROUTINE
251 0A072   41074 0400A068         PTR     VPOS0   POINTER TO THE FIRST ARGUMENT
252                                 .       .       .
253                                 .       .       .
254                                 .       .       .
```

Figure 18. HSCALE symbol with argument list and calling sequence

Figure 19 shows an example of a vertical bar symbol used in conjunction with a vertical scale. The VBAR symbol was produced by the calling sequence accompanying the figure. For this example, the bar originates from raster line 224 and limits at raster line 32 in the upward direction.

Assignment of value of Ø (integer format) to HPVBØ places the vertical bar in raster word column Ø (to coincide with the vertical scale). Assignment of any other value to this argument will place the bar in one of the other word columns and out of proximity of the scale.

The input variable YBARØ has been given an upper limit (VBULØ = 1.Ø) and a lower limit (VBLLØ = Ø.Ø).

Determination of KABARØ and KBBARØ can be accomplished using the linear relationship which exists between the scaled input YBARØ and the TV raster variable Y_R ($Ø \leq Y_R \leq 255$)

$$Y_R = KABARØ * YBARØ + KBARØ$$

From the figure $Y_R = 32$ when YBAR = 1.Ø and $Y_R = 224$ when YBARØ = Ø.Ø. Using this information and the above relationship, two equations in KABARØ and KBBARØ can be solved simultaneously to give

KABARØ = -192.Ø, KBBARØ = 224.Ø

(8) Vertical Degree-of-Freedom (VDOF) subprogram. The VDOF subprogram provides for the generation of symbols which can be controlled to move in the vertical direction only. Proper scaling and location of a VDOF symbol is similar to the VBAR symbol. The VDOF symbol requires that the subrouting arguments, as defined below, be pre-set in the SYMGEN in the order specified. The suffix, small n, serves as a VDOF symbol identifier. The present configuration of the SYMGEN permits a total of nine VDOF symbols to be generated per frame.

YDOFn -- Symbol input device command (± 1.0 max value, fl pt)

KAVDn -- Scaling parameter (fl pt)

KBVDn -- Scaling parameter (fl pt)

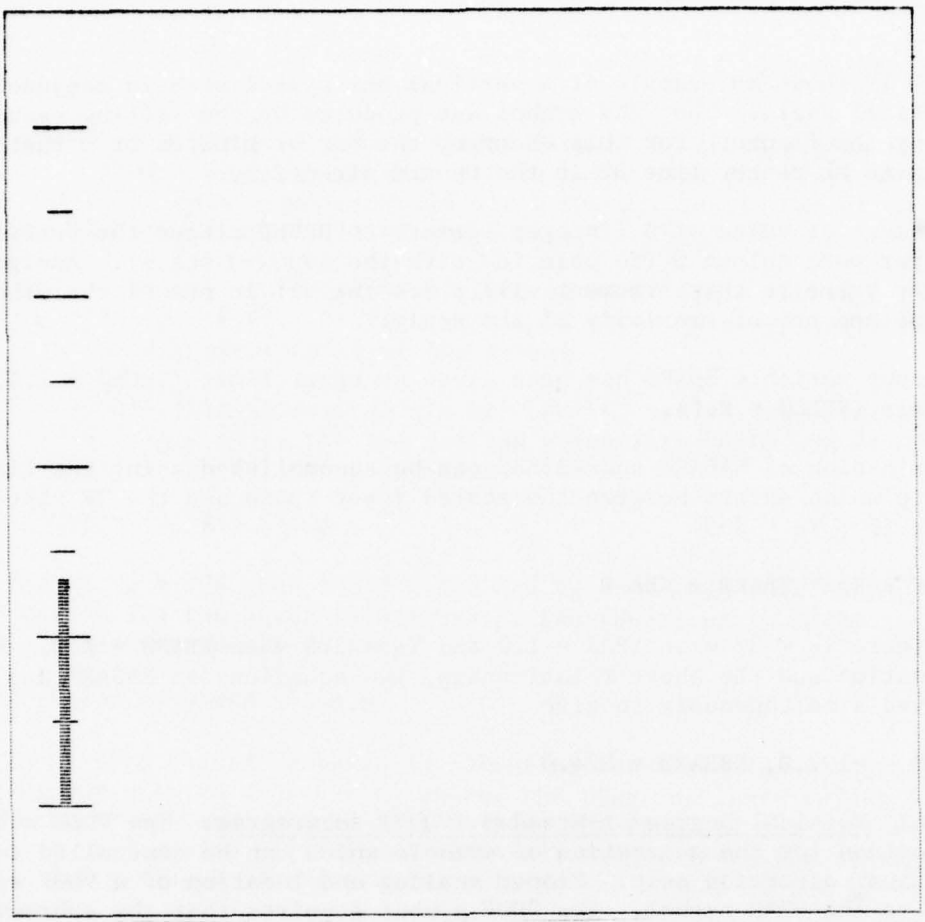
HPVDn -- Raster word column number of symbol horizontal position (integer)

VDSELn -- VDOF symbol selection code (integer)

VDULn -- VDOF symbol upper limit (fl pt)

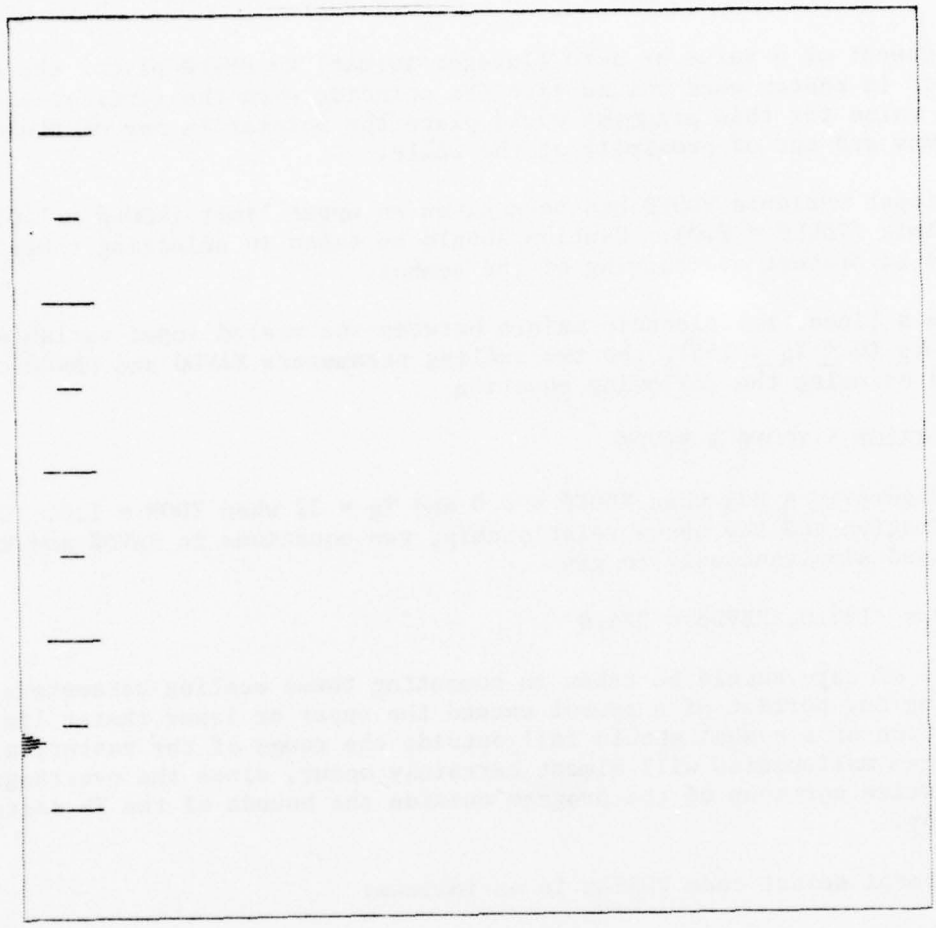
VDLLn -- VDOF symbol lower limit (fl pt)

Figure 20 shows an example of a VDOF symbol (right pointing indicator) used in conjunction with a vertical scale. The VDOF symbol was produced by the calling sequence and argument list accompanying the figure. For this example, the pointer is free to move to raster line 32 in the upward direction and raster line 224 in the downward direction. The pointers' zero position is raster line 224.



```
260                                 .     .     .
261                                 .     .     .
262                                 .     .     .
263 0A07E   41086 3FD55326 YBAR0    DEC   0.3333  COMMANDED BAR LENGTH
264 0A080   41088 C4200000 KABAR0   DEC   -192.0  SCALING PARAMETER
265 0A082   41090 44700000 KBBAR0   DEC   224.0   SCALING PARAMETER
266 0A084   41092 00000000 HPVB0    DEC   0       BAR WORD COLUMN POSITION
267 0A086   41094 00000002 BARSL0   DEC   2       BAR POSITION WITHIN THE WORD COLUMN
268 0A088   41096 40C00000 VBUL0    DEC   1.0     BAR UPPER COMMAND LIMIT
269 0A08A   41098 00000000 VBLL0    DEC   0.0     BAR LOWER COMMAND LIMIT
270                                 .     .     .
271                                 .     .     .
272                                 .     .     .
273 0A08C   41100 64046AAE         JS    VSCALE  GENERATE A VERTICAL
274 0A08E   41102 0400A052         PTR   HPOS0   VSCALE ARGUMENT
275 0A090   41104 64046B8A         JS    VBAR    CALL THE BAR SUBROUTINE
276 0A092   41106 0400A07E         PTR   YBAR0   POINTER TO THE FIRST ARGUMENT
277                                 .     .     .
278                                 .     .     .
279                                 .     .     .
```

Figure 19. VBAR symbol with argument list and calling sequence



```
                                .       .       .
                                .       .       .
                                .       .       .
0A09E   41118 3EE66666 YDOF0   DEC     0.1     COMMANDED SYMBOL POSITION
0A0A0   41120 C4200000 KAVD0   DEC     -192.0  SCALING PARAMETER
0A0A2   41122 44700000 KBVD0   DEC     224.0   SCALING PARAMETER
0A0A4   41124 00000000 HPVD0   DEC     0       HORIZONTAL WORD COLUMN POSITION
0A0A6   41126 00000001 VDSEL0  DEC     1       SYMBOL SELECT CODE - RT POINTING IND
0A0A8   41128 40C00000 VDUL0   DEC     1.0     SYMBOL UPPER LIMIT
0A0AA   41130 00000000 VDLL0   DEC     0.0     SYMBOL LOWER LIMIT
                                .       .       .
                                .       .       .
                                .       .       .
0A0AC   41132 6404CAAE         JS      VSCALE  GENERATE A VERTICAL SCALE
0A0AE   41134 0400A052         PTR     HPOS0   VSCALE ARGUMENT
0A0B0   41136 64046C16         JS      VDOF    CALL THE VDOF SUBROUTINE
0A0B2   41138 0400A09E         PTR     YDOF0   POINTER TO THE FIRST ARGUMENT
                                .       .       .
                                .       .       .
                                .       .       .
```

Figure 20. VDOF symbol with argument list and calling sequence

Assignment of the value of zero (integer format) to argument VDSELØ causes the VDOF routine to select a left pointing indicator. Assignment of the value of one to this argument would cause the VDOF to select a right pointing indicator.

Assignment of a value of zero (integer format) to HPVDØ places the selected pointer in raster word column zero (to coincide with the vertical scale). Any other value for this argument would place the pointer in one of the other word columns and out of proximity of the scale.

The input variable YDOFØ has been given an upper limit (VDULØ = 1.0) and a lower limit (VDLLØ = Ø.Ø). Caution should be taken in selecting these limit parameters to prevent overranging of the symbol.

Since a linear relationship exists between the scaled input variable YDOFØ and Y_R ($0 \leq Y_R \leq 255$), the two scaling parameters KAVDØ and KBVDØ can be determined by using the following equation

$$Y_R = KAVDØ * YDOFØ + KBVDØ$$

From the figure Y_R = 224 when YDOFØ = 0.0 and Y_R = 32 when YDOF = 1.0. Using this information and the above relationship, two equations in KAVDØ and KBVDØ can be solved simultaneously to give

KAVDØ = -192.0, KBVDØ = 224.0

Some degree of care should be taken in computing these scaling parameters to avoid having any portion of a symbol exceed the upper or lower raster line. If any portion of a symbol should fall outside the range of the raster, a computer program malfunction will almost certainly occur, since the overranging will over-write portions of the program outside the bounds of the TV raster memory array.

The symbol select code VDSELn is as follows:

n	Symbol
0	Right pointing indicator
1	Left pointing indicator
2	Ref mark - right side of scale
3	Ref mark - left side of scale
4	CRUISE alpha symbol
5	TRANS alpha symbol
6	HOVER alpha symbol
7	BOB-UP alpha symbol

(9) Vertical and Horizontal Degree-of-Freedom (XYDOF) subprogram. The XYDOF subprogram provides for the generation of fixed size symbols which can be controlled to move in the vertical and horizontal directions. Proper selection and scaling of an XYDOF symbol requires that the subroutine arguments, as defined below, be pre-set in the SYMGEN routine in the order specified. The suffix, small n, serves as an XYDOF symbol identifier. The present configuration of SYMGEN permits a total of 13 XYDOF symbols to be generated per frame.

XFXn -- Symbol input horizontal drive (fl pt maximum absolute value = 1.Ø)

YFXn -- Symbol input vertical drive variable (fl pt maximum absolute value = 1.Ø)

KAFXn -- Scaling parameter - vertical input (fl pt format)

KBFXn -- Scaling parameter - vertical input (fl pt)

KCFXn -- Scaling parameter - horizontal input (fl pt)

KDFXn -- Scaling parameter - horizontal input (fl pt)

XYn -- XYDOF symbol selection code (integer)

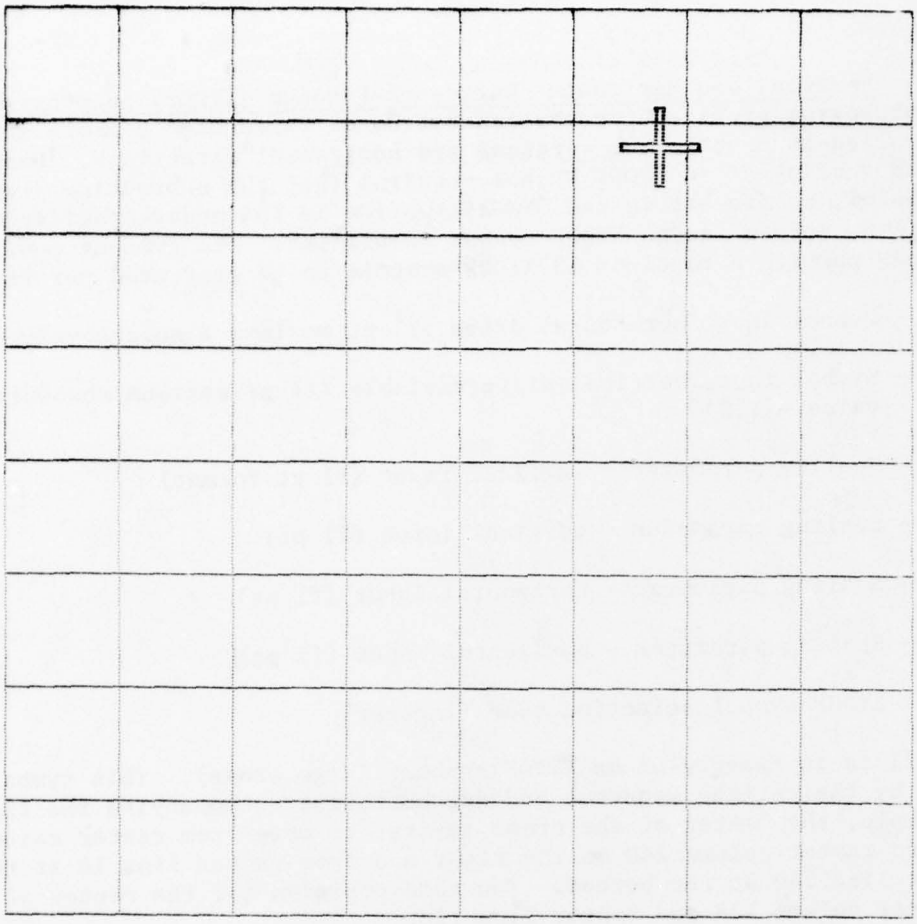
Figure 21 is an example of an XYDOF symbol (large cross). This symbol was produced by the calling sequence and argument list accompanying the figure. For this example, the center of the cross is free to move from raster column 16 on the left to raster column 240 on the right and from raster line 16 at the top to raster line 240 at the bottom. The zero position for the center of the cross is raster column 128 and raster line 128.

As in the case of all other symbols, when determining the pre-set values of the scaling parameters, care should be taken to prevent overranging of the symbols, since this will over-write portions of the program outside the bounds of the TV raster memory array and cause the program to "hang up" during execution. Since, for the XYDOF subprogram, the YFXn and XFXn variables are limited to $\pm$ 1.Ø internal to the program and cannot te adjusted (as in the VDOF program), additional care must be taken when determining the scaling parameters to insure that the full range of these variables is allowed. A further consideration which must be made in preventing overranging is to include the overall size of the symbol when computing the scaling parameters. Even though the symbol sizes vary, each symbol should be assumed to 32 by 32 bits (no XYDOF symbol exceeds this size), and scaled to limit at least 16 bits from the outside edge of the raster array.

Determination of the scaling parameters for the example uses the linear relationship that exists between the raster coordinate system (X_R, Y_R) and the input coordinate system (XFX2, YFX2).

Y_R = KAFX2 * YFX2 + KBFX2

X_R = KCFX2 * XFX2 + KDFX2



```
310                              .        .    .
311                              .        .    .
312                              .        .    .
313 0A0BE   41150 40400000 XFX2   DEC   0.5      COMMANDED SYMBOL HORIZONTAL POSITION
314 0A0C0   41152 40666666 YFX2   DEC   0.8      COMMANDED SYMBOL VERTICAL POSITION
315 0A0C2   41154 C3900000 KAFX2  DEC   -112.0   SCALING PARAMETER
316 0A0C4   41156 44400000 KBFX2  DEC   128.0    SCALING PARAMETER
317 0A0C6   41158 43F00000 KCFX2  DEC   112.0    SCALING PARAMETER
318 0A0C8   41160 44400000 KDFX2  DEC   128.0    SCALING PARAMETER
319 0A0CA   41162 00000002 XY2    DEC   2        SYMBOL SELECT CODE - LARGE CROSS
320                              .        .    .
321                              .        .    .
322                              .        .    .
323 0A0CC   41164 64046CF2       JS    XYDOF    CALL THE XYDOF SUBROUTINE
324 0A0CE   41166 0400A0BE       PTR   XFX2     POINTER TO THE FIRST ARGUMENT
325                              .        .    .
326                              .        .    .
327                              .        .    .
```

Figure 21. XYDOF symbol with argument list and calling sequence

From Figure 21, it can be seen that

Y_R = 16 when YFX2 = 1.Ø

Y_R = 240 when YFX2 = -1.Ø

X_R = 16 when YFX2 = -1.Ø

X_R = 240 when XFX2 = 1.Ø

Using this information, two equations in KAFX2 and KBFX2 are solved simultaneously to obtain

KAFX2 = -112.Ø and KBFX2 = 128.Ø

and two equations in KCFX2 and KDFX2 are solved to obtain

KCFX2 = +112.Ø and KDFX2 = 128.Ø

The symbol select code XYn is as follows:

n	Symbol
0	Male Symbol
1	Female Symbol
2	Large Cross
3	Small Cross
4	Large Circle
5	Small Circle
6	Small Solid Circle
7	Down Pointer
8	Up Pointer
9	Diamond
10	Large Segmented Circle
11	Large Square
12	Attitude Reference Mark

6. SUMMARY OF EXECUTION TIMES AND MEMORY REQUIREMENTS FOR THE DSG SUBROUTINES

To enable a user to estimate the memory requirements and execution time for a particular symbol set, the following table contains a summary of this information for each of the subroutines and the SYMGEN routine. Some of the

execution times for the individual symbol types may vary, depending on the symbol's size. For example, a short vertical bar will take less execution time than a long bar. For these cases, a range is specified.

Routine	Memory Requirement (Full Words)	Execution Time (ms)
SYMGEN	471	1
ATLINE	297	6
VECTOR	240	2-6
AIRSPD	365	2
COMPASS	465	3
VSCALE	50	.25
HSCALE	60	.75
VBAR	70	.1-1
VDOF	110	.25
XYDOF	360	1
DROUT	200	1-2

APPENDIX A

DIGITAL SYMBOLOGY GENERATOR COMPUTER LISTINGS

This appendix contains the SKC-2000 airborne computer assembly language instruction mnemonics (Table A1) and the complete SKC-2000 computer listings for the routines described in this report.

```
FOCAP-S V10.03 PAGE   1
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

    1                       .....................................................................................
    2                       * STARTING LOCATIONS FOR SUBPROGRAMS AND STORAGE
    3 00436   1078          COSF    SETX    0436
    4 00444   1092          COSFA   SETX    0444
    5 006BA   1722          SINF    SETX    06BA
    6 006C6   1734          SINFA   SETX    06C6
    7 0070C   1804          TANF    SETX    070C
    8 00718   1816          TANFA   SETX    0718
    9 03E00  15872          LSICMN  SETD    15872
   10 07A00  31232          TODBUG  SETX    7A00
   11 06000  24576          ATLINE  SETD    24576
   12 06252  25170          VECTOR  SETD    25170
   13 06432  25650          COMPASS SETD    25650
   14 067D4  26580          AIRSPD  SETD    26580
   15 06AAE  27310          VSCALE  SETD    27310
   16 06B12  27410          HSCALE  SETD    27410
   17 06B8A  27530          VBAR    SETD    27530
   18 06C16  27670          VDOF    SETD    27670
   19 06CF2  27890          XYDOF   SETD    27890
   20 06F62  28610          DRDOUT  SETD    28610
   21 07152  29010          SYMGEN  SETD    29010
   22 074D6  29910          DMAOUT  SETD    29910
   23 08000  32768          CORECMN SETD    32768
   24 094D4  38100          ALFANU  SETD    38100
   25 04000  16384          MAIN    SETX    4000
   26 04100  16640          PRNTSM  SETX    4100
   27                       *
   28                       *COMMON SET SYMBOLS
   29 01000   4096          RSTRW   SETD    4096 *NO. OF RASTER WORDS
   30 00800   2048          HRSTRW  SETD    2048 * RSTRW/2
   31 00100    256          RL      SETD     256 *NO. OF RASTER LINES
   32 00200    512          RLX2    SETD     512 *2*(RL)
   33 00008      8          LGRL    SETD     8   *LOG2(RL)
   34 00080    128          HRL     SETD     128 *RL/2
   35 00007      7          LGHRL   SETD     7   *LOG2(HRL)
   36 00008      8          WPL     SETD     8   *NO. OF 32 BIT WORDS/LINE
   37 00003      3          LGWPL   SETD     3   *LOG2(WPL)
   38 00010     16          WPLX2   SETD     16  *2*(WPL)
   39 00100    256          BPL     SETD     256 *NO. OF BITS/LINE
   40 00008      8          LGBPL   SETD     8   *LOG2(BPL)
   41 00200    512          BPLX2   SETD     512 *2*(BPL)
   42 00020     32          BPW     SETD     32  *NO. OF BITS/WORD
   43 00005      5          LGBPW   SETD      5 *LOG2(BPW)
   44 00040     64          BPWX2   SETD     64 *2*(BPW)
   45                       *
   46 03E00  15872                  ORG     LSICMN
   47 03E00  15872          ARGLST  BSS     20       STORAGE FOR ARGUMENT LISTS XFERED INTO EACH SUBROUTINE
   48 03E14  15892          TEMP    BSS     10
   49                       *
   50 08000  32768                  ORG     CORECMN
   51 08000  32768          TVRSTR  BSS     RSTRW
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   52 09000  36864           COSTBL BSS      RLX2+2
   53 09202  37378           TANTBL BSS      RLX2+2
   54 09404  37892 00000001 BMSK0  HEX      1
   55 09406  37894 00000002        HEX      2
   56 09408  37896 00000004        HEX      4
   57 0940A  37898 00000008        HEX      8
   58 0940C  37900 00000010        HEX      10
   59 0940E  37902 00000020        HEX      20
   60 09410  37904 00000040        HEX      40
   61 09412  37906 00000080        HEX      80
   62 09414  37908 00000100        HEX      100
   63 09416  37910 00000200        HEX      200
   64 09418  37912 00000400        HEX      400
   65 0941A  37914 00000800        HEX      800
   66 0941C  37916 00001000        HEX      1000
   67 0941E  37918 00002000        HEX      2000
   68 09420  37920 00004000        HEX      4000
   69 09422  37922 00008000        HEX      8000
   70 09424  37924 00010000        HEX      10000
   71 09426  37926 00020000        HEX      20000
   72 09428  37928 00040000        HEX      40000
   73 0942A  37930 00080000        HEX      80000
   74 0942C  37932 00100000        HEX      100000
   75 0942E  37934 00200000        HEX      200000
   76 09430  37936 00400000        HEX      400000
   77 09432  37938 00800000        HEX      800000
   78 09434  37940 01000000        HEX      1000000
   79 09436  37942 02000000        HEX      2000000
   80 09438  37944 04000000        HEX      4000000
   81 0943A  37946 08000000        HEX      8000000
   82 0943C  37948 10000000        HEX      10000000
   83 0943E  37950 20000000        HEX      20000000
   84 09440  37952 40000000        HEX      40000000
   85 09442  37954 80000000        HEX      80000000
   86 09444  37956 80000000 BMSK1  HEX      80000000
   87 09446  37958 40000000        HEX      40000000
   88 09448  37960 20000000        HEX      20000000
   89 0944A  37962 10000000        HEX      10000000
   90 0944C  37964 08000000        HEX      8000000
   91 0944E  37966 04000000        HEX      4000000
   92 09450  37968 02000000        HEX      2000000
   93 09452  37970 01000000        HEX      1000000
   94 09454  37972 00800000        HEX      800000
   95 09456  37974 00400000        HEX      400000
   96 09458  37976 00200000        HEX      200000
   97 0945A  37978 00100000        HEX      100000
   98 0945C  37980 00080000        HEX      80000
   99 0945E  37982 00040000        HEX      40000
  100 09460  37984 00020000        HEX      20000
  101 09462  37986 00010000        HEX      10000
  102 09464  37988 00008000        HEX      8000
  103 09466  37990 00004000        HEX      4000
  104 09468  37992 00002000        HEX      2000
  105 0946A  37994 00001000        HEX      1000
  106 0946C  37996 00000800        HEX      800
  107 0946E  37998 00000400        HEX      400
  108 09470  38000 00000200        HEX      200
  109 09472  38002 00000100        HEX      100
  110 09474  38004 00000080        HEX      80
  111 09476  38006 00000040        HEX      40
  112 09478  38008 00000020        HEX      20
  113 0947A  38010 00000010        HEX      10
  114 0947C  38012 00000008        HEX      8
  115 0947E  38014 00000004        HEX      4
  116 09480  38016 00000002        HEX      2
  117 09482  38018 00000001        HEX      1
  118 09484  38020 00000000 ZERO   HEX      0    * ZERO
  119 09404  37892           IONE   EQU      BMSK0 *INTEGER ONE
  120 09486  38022 FFFFFFFF ONES   HEX      FFFFFFFF  * ALL BITS SET
  121 09446  37958           XHALF  EQU      BMSK1+2  * .5B0 FX. PT.
  122 09488  38024 7FFFFFFF PLUS1  HEX      7FFFFFFF * +1.0B0 FX. PT.
  123 09444  37956           MINUS1 EQU      BMSK1    * -1.0B0 FX. PT.
  124 09484  38020           FZERO  EQU      ZERO * FL. PT. 0.0
  125 0948A  38026 40C00000 ONE    DEC      1.0 * FL. PT. ONE
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126 0948C  38028 C0000000 MONE    DEC     -1.0 *-1.0 FL. PT.
127 0948E  38030 40400000 FHALF   DEC      0.5  *+0.5 FL. PT.
128 09490  38032 BF800000 FMHALF  DEC     -0.5  *-0.5 FL. PT.
129 09492  38034 44400000 F128    DEC      128.0  *FL PT 128.0
130 09494  38036 416487ED PI      DEC      3.1415927 * PI
131 09496  38038 40E487EB PIOV2   DEC      1.570796 *(PI/2)
132 09498  38040 406487ED PIOV4   DEC      0.7853982 * (PI/4)
133 0949A  38042          TANFNC BSS      2
134 0949C  38044          GLBRTN BSS      2
135                       *
136                       ..................................................................................
137                       * SYMGEN -- MAIN ROUTINE FOR GENERATION OF SYMBOLS
138                       *
139 07152  29010                 ORG     SYMGEN
140 07152  29010 040071A6       PTR     RTAMN
141 07154  29012 DC01718E START  STS     SAVS      SAVE THE STATUS REG ,MEMORY INTRPTS SHOULD BE ENABLED
142 07156  29014 3C007190       STA     SAVA      SAVE THE A REG
143 07158  29016 7C007192       STB     SAVB      SAVE THE B REG
144 0715A  29018 1C007194       STX     0,SAVX    SAVE THE INDEX REG USED BY THE SYMGEN ROUTINES
145 0715C  29020 1C207196       STX     4,SAVX+2
146 0715E  29022 1C307198       STX     6,SAVX+4
147 07160  29024 1C40719A       STX     8,SAVX+6
148 07162  29026 1C487190       STX     9,SAVX+8
149 07164  29028 1C60719E       STX     12,SAVX+10
150 07166  29030 1C6871A0       STX     13,SAVX+12
151 07168  29032 1C1871A2       STX     3,SAVX+14
152 0716A  29034 1C5071A4       STX     10,SAVX+16
153 0716C  29036 64307346 STRT0   JGU     STRT1
154 0716E  29038 9C01718E RETURN LDS     SAVS      RESTORE THE STATUS REG
155 07170  29040 5C2071A6       LDX     4,RTAMN
156 07172  29042 6C220002       IMP     4,2,M
157 07174  29044 1C2071A6       STX     4,RTAMN
158 07176  29046 14007190       LDA     SAVA      RESTORE THE A REG
159 07178  29048 54007192       LDB     SAVB      RESTORE THE B REG
160 0717A  29050 5C007194       LDX     0,SAVX    RESTORE THE INDEX REG USED BY THE SYMGEN ROUTINES
161 0717C  29052 5C207196       LDX     4,SAVX+2
162 0717E  29054 5C307198       LDX     6,SAVX+4
163 07180  29056 5C40719A       LDX     8,SAVX+6
164 07182  29058 5C487190       LDX     9,SAVX+8
165 07184  29060 5C60719E       LDX     12,SAVX+10
166 07186  29062 5C6871A0       LDX     13,SAVX+12
167 07188  29064 5C1871A2       LDX     3,SAVX+14
168 0718A  29066 5C5071A4       LDX     10,SAVX+16
169 0718C  29068 740071A6       RTA     RTAMN     RETURN TO THE MAIN PROGRAM
170                       *
171                       * STORAGE FOR SAVING THE REGISTERS
172 0718E  29070          SAVS    BSS     2
173 07190  29072          SAVA    BSS     2
174 07192  29074          SAVB    BSS     2
175 07194  29076          SAVX    BSS      18
176 071A6  29094 00009CEC RTAMN   HEX     9CEC      SUBROUTINE RETURN ADDRESS
177                       *
178                       * SYMBOL DRIVE INPUT STORAGE AND ARGUMENT LISTS
179                       *
180                       * ATLINE ARGUMENT LIST
181 071A8  29096 3FCCCCCC FI      DEC     0.3       COMMANDED ROLL ANGLE - RADIANS
182 071AA  29098 BF199999 TH      DEC     -0.2      COMMANDED PITCH ANGLE - RADIANS
183                       * VECTOR ARGUMENT LIST
184 071AC  29100 00000000 X1      DEC     0.0       BASE POINT X COMMAND
185 071AE  29102 00000000 Y1      DEC     0.0       BASE POINT Y COMMAND
186 071B0  29104 40600000 X2      DEC     0.75      END POINT X COMMAND
187 071B2  29106 3F000000 Y2      DEC     0.25      END POINT Y COMMAND
188 071B4  29108 42C00000 MARGIN  DEC     16.0      WIDTH OF OUTER BOUNDARY
189                       * VSCALE NO. 0 ARGUMENT LIST
190 071B6  29110 00000000 HPOS0   DEC     0         SCALE POSITION
191 071B8  29112 00000080 VSCLC0  DEC     128       SCALE CENTER - RASTER LINE NO.
192 071BA  29114 00000018 VSPC0   DEC     24        NO. OF RASTER LINES BETWEEN MARKS
193 071BC  29116 00000008 VMRKS0  DEC     8         NO. OF SCALE MARKS - EXCLUDING CENTER MARK
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194                             * VSCALE NO. 1 ARGUMENT LIST
195 071BE  29118 00000007 HPOS1  DEC     7        SCALE POSITION
196 071C0  29120 00000080 VSCLC1 DEC     128      SCALE CENTER - RASTER LINE NO.
197 071C2  29122 00000008 VSPC1  DEC     8        NO. OF RASTER LINES BETWEEN MARKS
198 071C4  29124 00000018 VMRKS1 DEC     24       NO. OF SCALE MARKS - EXCLUDING CENTER MARK
199                             * HSCALE NO. 0 ARGUMENT LIST
200 071C6  29126 000000E0 VPOS0  DEC     224      VERTICAL POSITION - RASTER LINE NO.
201 071C8  29128 00000003 HSTRT0 DEC     3        STARTING WORD COLUMN NO. OF SCALE
202 071CA  29130 00000002 HMSK0  DEC     2        NO. OF DIVISIONS / WORD COLUMN
203 071CC  29132 00000002 HSIZE0 DEC     2        WIDTH OF SCALE IN WORD COLUMNS
204                             * HSCALE NO. 1 ARGUMENT LIST
205 071CE  29134 00000020 VPOS1  DEC     32       VERTICAL POSITION - RASTER LINE NO.
206 071D0  29136 00000003 HSTRT1 DEC     3        STARTING WORD COLUMN NO. OF SCALE
207 071D2  29138 00000002 HMSK1  DEC     2        NO. OF DIVISIONS / WORD COLUMN
208 071D4  29140 00000002 HSIZE1 DEC     2        WIDTH OF SCALE IN WORD COLUMNS
209                             * VBAR NO. 0 ARGUMENT LIST
210 071D6  29142 3FD55326 VBAR0  DEC     0.3333   COMMANDED BAR LENGTH
211 071D8  29144 C4200000 KABAR0 DEC     -192.0   SCALING PARAMETER
212 071DA  29146 44700000 KBBAR0 DEC     224.0    SCALING PARAMETER
213 071DC  29148 00000000 HPVB0  DEC     0        HORIZONTAL BAR POSITION - WORD COLUMN 1
214 071DE  29150 00000002 BARSL0 DEC     2        BAR POSITION WITHIN THE WORD COLUMN
215 071E0  29152 40C00000 VBUL0  DEC     1.0      BAR MAXIMUM COMMAND LIMIT
216 071E2  29154 00000000 VBLL0  DEC     0.0      BAR LOWER COMMAND LIMIT
217                             * VBAR NO. 1 ARGUMENT LIST
218 071E4  29156 BFAAACD9 VBAR1  DEC     -0.3333  COMMANDED BAR LENGTH
219 071E6  29158 C3A00000 KABAR1 DEC     -96.0    SCALING PARAMETER
220 071E8  29160 44400000 KBBAR1 DEC     128.0    SCALING PARAMETER
221 071EA  29162 00000000 HPVB1  DEC     0        HORIZONTAL BAR POSITION - WORD COLUMN
222 071EC  29164 00000000 BARSL1 DEC     0        BAR POSITION WITHIN THE WORD COLUMN
223 071EE  29166 40C00000 VBUL1  DEC     1.0      BAR MAXIMUM COMMAND LIMIT
224 071F0  29168 C0000000 VBLL1  DEC     -1.0     BAR LOWER COMMAND LIMIT
225                             * VDOF NO. 0 ARGUMENT LIST
226 071F2  29170 3EE66666 VDOF0  DEC     0.1      COMMANDED SYMBOL POSITION
227 071F4  29172 C4200000 KAVD0  DEC     -192.0   SCALING PARAMETER
228 071F6  29174 44700000 KBVD0  DEC     224.0    SCALING PARAMETER
229 071F8  29176 00000000 HPVD0  DEC     0        HORIZONTAL SYMBOL POSITION - WORD COLUMN NO.
230 071FA  29178 00000001 VDSEL0 DEC     1        SYMBOL SELECT CODE - RT POINTING INDICATOR
231 071FC  29180 40C00000 VDUL0  DEC     1.0      SYMBOL MAXIMUM COMMAND LIMIT
232 071FE  29182 00000000 VDLL0  DEC     0.0      SYMBOL LOWER COMMAND LIMIT
233                             * VDOF NO. 1 ARGUMENT LIST
234 07200  29184 404CCCCC YDOF1  DEC     0.6      COMMANDED SYMBOL POSITION
235 07202  29186 C3A00000 KAVD1  DEC     -96.0    SCALING PARAMETER
236 07204  29188 44400000 KBVD1  DEC     128.0    SCALING PARAMETER
237 07206  29190 00000000 HPVD1  DEC     0        HORIZONTAL SYMBOL POSITION - WORD COLUMN NO.
238 07208  29192 00000000 VDSEL1 DEC     0        SYMBOL SELECT CODE - LEFT POINTING INDICATOR
239 0720A  29194 40C00000 VDUL1  DEC     1.0      SYMBOL MAXIMUM COMMAND LIMIT
240 0720C  29196 C0000000 VDLL1  DEC     -1.0     SYMBOL LOWER COMMAND LIMIT
241                             * AIRSPEED ARGUMENT LIST
242 0720E  29198 00000000 ASPD   DEC     0.0      AIRSPEED INPUT COMMAND
243 07210  29200 00000061        DEC     97
244 07212  29202 0000080E        DEC     2062
245 07214  29204 000004FE        DEC     1278
246 07216  29206 00000000        HEX     0
247 07218  29208 00000000        HEX     0
248 0721A  29210 00000000        HEX     0
249                             * VDOF NO. 3 ARGUMENT LIST
250 0721C  29212 3FD55326 YDOF3  DEC     0.3333   COMMANDED SYMBOL POSITION
251 0721E  29214 C4200000 KAVD3  DEC     -192.0   SCALING PARAMETER
252 07220  29216 44700000 KBVD3  DEC     224.0    SCALING PARAMETER
253 07222  29218 00000007 HPVD3  DEC     7        HORIZONTAL SYMBOL POSITION - WORD COLUMN NO.
254 07224  29220 00000001 VDSEL3 DEC     1        SYMBOL SELECT CODE -   RT POINTING INDICATOR
255 07226  29222 40C00000 VDUL3  DEC     1.0      SYMBOL MAXIMUM COMMAND LIMIT
256 07228  29224 C0000000 VDLL3  DEC     -1.0     SYMBOL LOWER COMMAND LIMIT
257                             * VDOF NO. 4 ARGUMENT LIST
258 0722A  29226 00000000 YDOF4  DEC     0.0      COMMANDED SYMBOL POSITION
259 0722C  29228 C4200000 KAVD4  DEC     -192.0   SCALING PARAMETER
260 0722E  29230 44700000 KBVD4  DEC      224.0   SCALING PARAMETER
261 07230  29232 00000000 HPVD4  DEC     0        HORIZONTAL SYMBOL POSITION - WORD COLUMN NO.
262 07232  29234 00000002 VDSEL4 DEC     2        SYMBOL SELECT CODE - LEFT SIDE REFERENCE MARK
263 07234  29236 40C00000 VDUL4  DEC     1.0      SYMBOL MAXIMUM COMMAND LIMIT
264 07236  29238 C0000000 VDLL4  DEC     -1.0     SYMBOL LOWER COMMAND LIMIT
265                             * VDOF NO. 5 ARGUMENT LIST
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266 07238  29240 00000000 YDOF5   DEC      0.0       COMMANDED SYMBOL POSITION
267 0723A  29242 C3A00000 KAVD5   DEC      -96.0     SCALING PARAMETER
268 0723C  29244 44400000 KBVD5   DEC      128.0     SCALING PARAMETER
269 0723E  29246 00000000 HPVD5   DEC      0         HORIZONTAL SYMBOL POSITION - WORD COLUMN NO.
270 07240  29248 00000003 VDSEL5  DEC      3         SYMBOL SELECT CODE - RIGHT SIDE REFERENCE MARK
271 07242  29250 40C00000 VDUL5   DEC      1.0       SYMBOL MAXIMUM COMMAND LIMIT
272 07244  29252 C0000000 VDLL5   DEC      -1.0      SYMBOL LOWER COMMAND LIMIT
273                       * VDOF NO. 6 ARGUMENT LIST
274 07246  29254 00000000 YDOF6   DEC      0.0       COMMANDED SYMBOL POSITION
275 07248  29256 00000000 KAVD6   DEC      0.0       SCALING PARAMETER
276 0724A  29258 44700000 KBVD6   DEC      224.0     SCALING PARAMETER
277 0724C  29260 00000007 HPVD6   DEC      7         HORIZONTAL SYMBOL POSITION - WORD COLUMN NO.
278 0724E  29262 00000004 VDSEL6  DEC      4         SYMBOL SELECT CODE - FWD ALPHA CHAR
279 07250  29264 40C00000 VDUL6   DEC      1.0       SYMBOL MAXIMUM COMMAND LIMIT
280 07252  29266 C0000000 VDLL6   DEC      -1.0      SYMBOL LOWER COMMAND LIMIT
281                       * VDOF NO. 7 ARGUMENT LIST
282 07254  29268 00000000 YDOF7   DEC      0.0       COMMANDED SYMBOL POSITION
283 07256  29270 00000000 KAVD7   DEC      0.0       SCALING PARAMETER
284 07258  29272 44700000 KBVD7   DEC      224.0     SCALING PARAMETER
285 0725A  29274 00000007 HPVD7   DEC      7         HORIZONTAL SYMBOL POSITION - WORD COLUMN NO.
286 0725C  29276 00000005 VDSEL7  DEC      5         SYMBOL SELECT CODE - NOE ALPHA CHAR
287 0725E  29278 40C00000 VDUL7   DEC      1.0       SYMBOL MAXIMUM COMMAND LIMIT
288 07260  29280 C0000000 VDLL7   DEC      -1.0      SYMBOL LOWER COMMAND LIMIT
289                       * VDOF NO. 8 ARGUMENT LIST
290 07262  29282 00000000 YDOF8   DEC      0.0       COMMANDED SYMBOL POSITION
291 07264  29284 00000000 KAVD8   DEC      0.0       SCALING PARAMETER
292 07266  29286 44700000 KBVD8   DEC      224.0     SCALING PARAMETER
293 07268  29288 00000007 HPVD8   DEC      7         HORIZONTAL SYMBOL POSITION - WORD COLUMN NO.
294 0726A  29290 00000006 VDSEL8  DEC      6         SYMBOL SELECT CODE - HOV ALPHA CHAR
295 0726C  29292 40C00000 VDUL8   DEC      1.0       SYMBOL MAXIMUM COMMAND LIMIT
296 0726E  29294 C0000000 VDLL8   DEC      -1.0      SYMBOL LOWER COMMAND LIMIT
297                       * VDOF NO. 9 ARGUMENT LIST
298 07270  29296 00000000 YDOF9   DEC      0.0       COMMANDED SYMBOL POSITION
299 07272  29298 00000000 KAVD9   DEC      0.0       SCALING PARAMETER
300 07274  29300 44700000 KBVD9   DEC      224.0     SCALING PARAMETER
301 07276  29302 00000007 HPVD9   DEC      7         HORIZONTAL SYMBOL POSITION - WORD COLUMN NO.
302 07278  29304 00000007 VDSEL9  DEC      7         SYMBOL SELECT CODE - BOB ALPHA CHAR
303 0727A  29306 40C00000 VDUL9   DEC      1.0       SYMBOL MAXIMUM COMMAND LIMIT
304 0727C  29308 C0000000 VDLL9   DEC      -1.0      SYMBOL LOWER COMMAND LIMIT
305                       * XYDOF NO. 0 ARGUMENT LIST
306 0727E  29310 40400000 XFX0    DEC      0.5       COMMANDED HORIZONTAL SYMBOL POSITION
307 07280  29312 BF800000 YFX0    DEC      -0.5      COMMANDED VERTICAL SYMBOL POSITION
308 07282  29314 C3900000 KAFX0   DEC      -112.0    SCALING PARAMETER
309 07284  29316 44400000 KBFX0   DEC      128.0     SCALING PARAMETER
310 07286  29318 43F00000 KCFX0   DEC      112.0     SCALING PARAMETER
311 07288  29320 44400000 KDFX0   DEC      128.0     SCALING PARAMETER
312 0728A  29322 0000000B XY0     DEC      11        SYMBOL SELECT CODE - LARGE BOX
313                       * XYDOF NO. 1 ARGUMENT LIST
314 0728C  29324 00000000 XFX1    DEC      0.0       COMMANDED HORIZONTAL SYMBOL POSITION
315 0728E  29326 00000000 YFX1    DEC      0.0       COMMANDED VERTICAL SYMBOL POSITION
316 07290  29328 00000000 KAFX1   DEC      0.0       SCALING PARAMETER
317 07292  29330 43440000 KBFX1   DEC      34.0      SCALING PARAMETER
318 07294  29332 43E00000 KCFX1   DEC      96.0      SCALING PARAMETER
319 07296  29334 44400000 KDFX1   DEC      128.0     SCALING PARAMETER
320 07298  29336 00000008 XY1     DEC      8         SYMBOL SELECT CODE - HEADING REF SYMBOL (UP POINTER)
321                       * XYDOF NO. 2 ARGUMENT LIST
322 0729A  29338 BF800000 XFX2    DEC      -0.5      COMMANDED HORIZONTAL SYMBOL POSITION
323 0729C  29340 40666666 YFX2    DEC      0.8       COMMANDED VERTICAL SYMBOL POSITION
324 0729E  29342 C3900000 KAFX2   DEC      -112.0    SCALING PARAMETER
325 072A0  29344 44400000 KBFX2   DEC      128.0     SCALING PARAMETER
326 072A2  29346 43F00000 KCFX2   DEC      112.0     SCALING PARAMETER
327 072A4  29348 44400000 KDFX2   DEC      128.0     SCALING PARAMETER
328 072A6  29350 00000002 XY2     DEC      2         SYMBOL SELECT CODE - LARGE CROSS
329                       * XYDOF NO. 3 ARGUMENT LIST
330 072A8  29352 C0199999 XFX3    DEC      -0.8      COMMANDED HORIZONTAL SYMBOL POSITION
331 072AA  29354 40400000 YFX3    DEC      0.5       COMMANDED VERTICAL SYMBOL POSITION
332 072AC  29356 C3900000 KAFX3   DEC      -112.0    SCALING PARAMETER
333 072AE  29358 44400000 KBFX3   DEC      128.0     SCALING PARAMETER
334 072B0  29360 43F00000 KCFX3   DEC      112.0     SCALING PARAMETER
335 072B2  29362 44400000 KDFX3   DEC      128.0     SCALING PARAMETER
336 072B4  29364 00000003 XY3     DEC      3         SYMBOL SELECT CODE - SMALL CROSS
337                       * XYDOF NO. 4 ARGUMENT LIST
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

338 072B6  29366 00000000 XFX4    DEC      0.0       COMMANDED HORIZONTAL SYMBOL POSITION
339 072B8  29368 00000000 YFX4    DEC      0.0       COMMANDED VERTICAL SYMBOL POSITION
340 072BA  29370 C3900000 KAFX4   DEC      -112.0    SCALING PARAMETER
341 072BC  29372 44400000 KBFX4   DEC      128.0     SCALING PARAMETER
342 072BE  29374 43F00000 KCFX4   DEC      112.0     SCALING PARAMETER
343 072C0  29376 44400000 KDFX4   DEC      128.0     SCALING PARAMETER
344 072C2  29378 00000004 XY4     DEC      4         SYMBOL SELECT CODE - LARGE CIRCLE
345                       * XYDOF NO. 5 ARGUMENT LIST
346 072C4  29380 40600000 XFX5    DEC      0.75      COMMANDED HORIZONTAL SYMBOL POSITION
347 072C6  29382 40400000 YFX5    DEC      0.5       COMMANDED VERTICAL SYMBOL POSITION
348 072C8  29384 C3900000 KAFX5   DEC      -112.0    SCALING PARAMETER
349 072CA  29386 44400000 KBFX5   DEC      128.0     SCALING PARAMETER
350 072CC  29388 43F00000 KCFX5   DEC      112.0     SCALING PARAMETER
351 072CE  29390 44400000 KDFX5   DEC      128.0     SCALING PARAMETER
352 072D0  29392 00000005 XY5     DEC      5         SYMBOL SELECT CODE - SMALL CIRCLE
353                       * XYDOF NO. 6 ARGUMENT LIST
354 072D2  29394 00000000 XFX6    DEC      0.0       COMMANDED HORIZONTAL SYMBOL POSITION
355 072D4  29396 00000000 YFX6    DEC      0.0       COMMANDED VERTICAL SYMBOL POSITION
356 072D6  29398 00000000 KAFX6   DEC      0.0       SCALING PARAMETER
357 072D8  29400 44700000 KBFX6   DEC      224.0     SCALING PARAMETER
358 072DA  29402 00000000 KCFX6   DEC      0.0       SCALING PARAMETER
359 072DC  29404 446E0000 KDFX6   DEC      220.0     SCALING PARAMETER
360 072DE  29406 00000006 XY6     DEC      6         SYMBOL SELECT CODE - SMALL SOLID CIRCLE
361                       * XYDOF NO. 7 ARGUMENT LIST
362 072E0  29408 00000000 XFX7    DEC      0.0       COMMANDED HORIZONTAL SYMBOL POSITION
363 072E2  29410 00000000 YFX7    DEC      0.0       COMMANDED VERTICAL SYMBOL POSITION
364 072E4  29412 00000000 KAFX7   DEC      0.0       SCALING PARAMETER
365 072E6  29414 43440000 KBFX7   DEC      34.0      SCALING PARAMETER
366 072E8  29416 43E00000 KCFX7   DEC      96.0      SCALING PARAMETER
367 072EA  29418 44400000 KDFX7   DEC      128.0     SCALING PARAMETER
368 072EC  29420 00000008 XY7     DEC      8         SYMBOL SELECT CODE - UP POINTER
369                       * XYDOF NO. 8 ARGUMENT LIST
370 072EE  29422 00000000 XFX8    DEC      0.0       COMMANDED HORIZONTAL SYMBOL POSITION
371 072F0  29424 00000000 YFX8    DEC      0.0       COMMANDED VERTICAL SYMBOL POSITION
372 072F2  29426 00000000 KAFX8   DEC      0.0       SCALING PARAMETER
373 072F4  29428 44400000 KBFX8   DEC      128.0     SCALING PARAMETER
374 072F6  29430 00000000 KCFX8   DEC      0.0       SCALING PARAMETER
375 072F8  29432 44400000 KDFX8   DEC      128.0     SCALING PARAMETER
376 072FA  29434 0000000C XY8     DEC      12        SYMBOL SELECT CODE - ATTITUDE REF MARK
377                       * XYDOF NO. 9 ARGUMENT LIST
378 072FC  29436 BFA00000 XFX9    DEC      -0.375    COMMANDED HORIZONTAL SYMBOL POSITION
379 072FE  29438 00000000 YFX9    DEC      0.0       COMMANDED VERTICAL SYMBOL POSITION
380 07300  29440 00000000 KAFX9   DEC      0.0       SCALING PARAMETER
381 07302  29442 44700000 KBFX9   DEC      224.0     SCALING PARAMETER
382 07304  29444 43400000 KCFX9   DEC      32.0      SCALING PARAMETER
383 07306  29446 44400000 KDFX9   DEC      128.0     SCALING PARAMETER
384 07308  29448 00000009 XY9     DEC      9         SYMBOL SELECT CODE - DIAMOND
385                       * XYDOF NO.10 ARGUMENT LIST
386 0730A  29450 00000000 XFX10   DEC      0.0       COMMANDED HORIZONTAL SYMBOL POSITION
387 0730C  29452 40400000 YFX10   DEC      0.5       COMMANDED VERTICAL SYMBOL POSITION
388 0730E  29454 C3900000 KAFX10  DEC      -112.0    SCALING PARAMETER
389 07310  29456 44400000 KBFX10  DEC      128.0     SCALING PARAMETER
390 07312  29458 43F00000 KCFX10  DEC      112.0     SCALING PARAMETER
391 07314  29460 44400000 KDFX10  DEC      128.0     SCALING PARAMETER
392 07316  29462 0000000A XY10    DEC      10        SYMBOL SELECT CODE - BROKEN CIRCLE
393                       * XYDOF NO.11 ARGUMENT LIST
394 07318  29464 00000000 XFX11   DEC      0.0       COMMANDED HORIZONTAL SYMBOL POSITION
395 0731A  29466 00000000 YFX11   DEC      0.0       COMMANDED VERTICAL SYMBOL POSITION
396 0731C  29468 C3900000 KAFX11  DEC      -112.0    SCALING PARAMETER
397 0731E  29470 44400000 KBFX11  DEC      128.0     SCALING PARAMETER
398 07320  29472 43F00000 KCFX11  DEC      112.0     SCALING PARAMETER
399 07322  29474 44400000 KDFX11  DEC      128.0     SCALING PARAMETER
400 07324  29476 0000000B XY11    DEC      11        SYMBOL SELECT CODE - BOX
401                       * XYDOF NO.12 ARGUMENT LIST
402 07326  29478 00000000 XFX12   DEC      0.0       COMMANDED HORIZONTAL SYMBOL POSITION
403 07328  29480 00000000 YFX12   DEC      0.0       COMMANDED VERTICAL SYMBOL POSITION
404 0732A  29482 00000000 KAFX12  DEC      0.0       SCALING PARAMETER
405 0732C  29484 44700000 KBFX12  DEC      224.0     SCALING PARAMETER
406 0732E  29486 43E00000 KCFX12  DEC      96.0      SCALING PARAMETER
407 07330  29488 44400000 KDFX12  DEC      128.0     SCALING PARAMETER
408 07332  29490 0000000C XY12    DEC      12        SYMBOL SELECT CODE - SMALL SOLID BOX
```

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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  409                       * COMPASS ARGUMENT LIST
  410 07334  29492 00000000 HDG     DEC     0.0       COMPASS INPUT COMMAND
  411                       * DRDOUT NO. 0 ARGUMENT LIST
  412 07336  29494 44C38000 DGTIN0 DEC     270.0     COMMANDED INPUT DECIMAL NUMBER
  413 07338  29496 00000003 NMB00  DEC     3         NUMBER OF ZEROS DISPLAYED FOR A ZERO INPUT
  414 0733A  29498 00000010 STLN0  DEC     16        STARTING RASTER LINE NUMBER
  415 0733C  29500 00000008 STWC0  DEC     8         STARTING WORD COLUMN NUMBER
  416 0733E  29502 00000000 TITLE0 DEC     0         TITLE OF DECIMAL READOUT -- HDG
  417                       *
  418                       * LOCAL VARIABLES FOR THIS SUBROUTINE
  419 07340  29504 00000000 SYMSEL DEC     0
  420 07342  29506 64300000 JGUINS HEX     64300000  JUMP GLOBAL OPCODE
  421 07344  29508          LOCRTN BSS     2
  422                       *
  423                       * THIS ROUTINE PERFORMS ONE TIME COMPUTATIONS AND SETS UP THE CODE TO ALLOW
  424                       *   THIS SECTION TO BE SKIPPED ON SUBSEQUENT PASSES
  425 07346  29510 6404749A STRT1  JS      TRGTBL    GENERATE THE TRIG TABLES
  426 07348  29512 34007350        LAE     STRT2
  427 0734A  29514 A4007342        ADU     JGUINS
  428 0734C  29516 3C00716C        STA     STRT0
  429 0734E  29518 6430716E        JGU     RETURN
  430                       *
  431                       * TRANSFER THE SYMBOL SELECT ARGUMENT
  432                       *
  433 07350  29520 140471A6 STRT2  LDA     RTAMN,I
  434 07352  29522 3C007340        STA     SYMSEL
  435                       *
  436 07354  29524 0700            NOP               CLEAR THE TVRSTR
  437                       * ROUTINE TO CALL THE SELECTED SYMBOL PROGRAMS
  438                       *
  439 07355  29525      0700
  439 07356  29526 14007340        LDA     SYMSEL    SYMSEL SPECIFIES WHICH SYMBOLS WERE SELECTED
  440 07358  29528 8C009444        SAM     BMSK1     CHECK IF SYMBOL 0 IS DESIRED
  441 0735A  29530 6006            JU      *+6
  441 0735B  29531      0700
  442 0735C  29532 64046000        JS      ATLINE
  443 0735E  29534 040071A8        PTR     F1
  444 07360  29536 14007340        LDA     SYMSEL
  445 07362  29538 8C009446        SAM     BMSK1+2   CHECK IF SYMBOL 1 IS DESIRED
  446 07364  29540 6006            JU      *+6
  446 07365  29541      0700
  447 07366  29542 64046252        JS      VECTOR
  448 07368  29544 040071AC        PTR     X1
  449 0736A  29546 14007340        LDA     SYMSEL
  450 0736C  29548 8C009448        SAM     BMSK1+4   CHECK IF SYMBOL 2 IS DESIRED
  451 0736E  29550 6006            JU      *+6
  451 0736F  29551      0700
  452 07370  29552 64046AAE        JS      VSCALE
  453 07372  29554 040071B6        PTR     HPOS0
  454 07374  29556 14007340        LDA     SYMSEL
  455 07376  29558 8C00944A        SAM     BMSK1+6   CHECK IF SYMBOL 3 IS DESIRED
  456 07378  29560 6006            JU      *+6
  456 07379  29561      0700
  457 0737A  29562 64046AAE        JS      VSCALE
  458 0737C  29564 040071BE        PTR     HPOS1
  459 0737E  29566 14007340        LDA     SYMSEL
  460 07380  29568 8C00944C        SAM     BMSK1+8   CHECK IF SYMBOL 4 IS DESIRED
  461 07382  29570 6006            JU      *+6
  461 07383  29571      0700
  462 07384  29572 64046B12        JS      HSCALE
  463 07386  29574 040071C6        PTR     VPOS0
  464 07388  29576 14007340        LDA     SYMSEL
  465 0738A  29578 8C00944E        SAM     BMSK1+10  CHECK IF SYMBOL 5 IS DESIRED
  466 0738C  29580 6006            JU      *+6
  466 0738D  29581      0700
  467 0738E  29582 64046B12        JS      HSCALE
  468 07390  29584 040071CE        PTR     VPOS1
  469 07392  29586 14007340        LDA     SYMSEL
  470 07394  29588 8C009450        SAM     BMSK1+12  CHECK IF SYMBOL 6 IS DESIRED
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 LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

471 07396  29590 6006          JU      *+6
471 07397  29591      0700
472 07398  29592 64046B8A      JS      VBAR
473 0739A  29594 040071D6      PTR     VBAR0
474 0739C  29596 14007340      LDA     SYMSEL
475 0739E  29598 8C009452      SAM     BMSK1+14 CHECK IF SYMBOL 7 IS DESIRED
476 073A0  29600 6006          JU      *+6
476 073A1  29601      0700
477 073A2  29602 64046B8A      JS      VBAR
478 073A4  29604 040071E4      PTR     VBAR1
479 073A6  29606 14007340      LDA     SYMSEL
480 073A8  29608 8C009454      SAM     BMSK1+16 CHECK IF SYMBOL 8 IS DESIRED
481 073AA  29610 6006          JU      *+6
481 073AB  29611      0700
482 073AC  29612 64046C16      JS      VDOF
483 073AE  29614 040071F2      PTR     VDOF0
484 073B0  29616 14007340      LDA     SYMSEL
485 073B2  29618 8C009456      SAM     BMSK1+18 CHECK IF SYMBOL 9 IS DESIRED
486 073B4  29620 6006          JU      *+6
486 073B5  29621      0700
487 073B6  29622 64046C16      JS      VDOF
488 073B8  29624 04007200      PTR     VDOF1
489 073BA  29626 14007340      LDA     SYMSEL
490 073BC  29628 8C009458      SAM     BMSK1+20 CHECK IF SYMBOL 10 IS DESIRED
491 073BE  29630 6006          JU      *+6
491 073BF  29631      0700
492 073C0  29632 640467D4      JS      AIRSPD
493 073C2  29634 0400720E      PTR     ASPD
494 073C4  29636 14007340      LDA     SYMSEL
495 073C6  29638 8C00945A      SAM     BMSK1+22 CHECK IF SYMBOL 11 IS DESIRED
496 073C8  29640 6006          JU      *+6
496 073C9  29641      0700
497 073CA  29642 64046C16      JS      VDOF
498 073CC  29644 0400721C      PTR     VDOF3
499 073CE  29646 14007340      LDA     SYMSEL
500 073D0  29648 8C00945C      SAM     BMSK1+24 CHECK IF SYMBOL 12 IS DESIRED
501 073D2  29650 6006          JU      *+6
501 073D3  29651      0700
502 073D4  29652 64046C16      JS      VDOF
503 073D6  29654 0400722A      PTR     VDOF4
504 073D8  29656 14007340      LDA     SYMSEL
505 073DA  29658 8C00945E      SAM     BMSK1+26 CHECK IF SYMBOL 13 IS DESIRED
506 073DC  29660 6006          JU      *+6
506 073DD  29661      0700
507 073DE  29662 64046C16      JS      VDOF
508 073E0  29664 04007238      PTR     VDOF5
509 073E2  29666 14007340      LDA     SYMSEL
510 073E4  29668 8C009460      SAM     BMSK1+28 CHECK IF SYMBOL 14 IS DESIRED
511 073E6  29670 6006          JU      *+6
511 073E7  29671      0700
512 073E8  29672 64046C16      JS      VDOF
513 073EA  29674 04007246      PTR     VDOF6
514 073EC  29676 14007340      LDA     SYMSEL
515 073EE  29678 8C009462      SAM     BMSK1+30 CHECK IF SYMBOL 15 IS DESIRED
516 073F0  29680 6006          JU      *+6
516 073F1  29681      0700
517 073F2  29682 64046C16      JS      VDOF
518 073F4  29684 04007254      PTR     VDOF7
519 073F6  29686 14007340      LDA     SYMSEL
520 073F8  29688 8C009464      SAM     BMSK1+32 CHECK IF SYMBOL 16 IS DESIRED
521 073FA  29690 6006          JU      *+6
521 073FB  29691      0700
522 073FC  29692 64046C16      JS      VDOF
523 073FE  29694 04007262      PTR     VDOF8
524 07400  29696 14007340      LDA     SYMSEL
525 07402  29698 8C009466      SAM     BMSK1+34 CHECK IF SYMBOL 17 IS DESIRED
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

526 07404  29700 6006          JU      *+6
526 07405  29701     0700
527 07406  29702 64046C16      JS      YDOF
528 07408  29704 04007270      PTR     YDOF9
529 0740A  29706 14007340      LDA     SYMSEL
530 0740C  29708 8C009468      SAM     BMSK1+36 CHECK IF SYMBOL 18 IS DESIRED
531 0740E  29710 6006          JU      *+6
531 0740F  29711     0700
532 07410  29712 64046CF2      JS      XYDOF
533 07412  29714 0400727E      PTR     XFX0
534 07414  29716 14007340      LDA     SYMSEL
535 07416  29718 8C00946A      SAM     BMSK1+38 CHECK IF SYMBOL 19 IS DESIRED
536 07418  29720 6006          JU      *+6
536 07419  29721     0700
537 0741A  29722 64046CF2      JS      XYDOF
538 0741C  29724 0400728C      PTR     XFX1
539 0741E  29726 14007340      LDA     SYMSEL
540 07420  29728 8C00946C      SAM     BMSK1+40 CHECK IF SYMBOL 20 IS DESIRED
541 07422  29730 6006          JU      *+6
541 07423  29731     0700
542 07424  29732 64046CF2      JS      XYDOF
543 07426  29734 0400729A      PTR     XFX2
544 07428  29736 14007340      LDA     SYMSEL
545 0742A  29738 8C00946E      SAM     BMSK1+42 CHECK IF SYMBOL 21 IS DESIRED
546 0742C  29740 6006          JU      *+6
546 0742D  29741     0700
547 0742E  29742 64046CF2      JS      XYDOF
548 07430  29744 040072A8      PTR     XFX3
549 07432  29746 14007340      LDA     SYMSEL
550 07434  29748 8C009470      SAM     BMSK1+44 CHECK IF SYMBOL 22 IS DESIRED
551 07436  29750 6006          JU      *+6
551 07437  29751     0700
552 07438  29752 64046CF2      JS      XYDOF
553 0743A  29754 040072B6      PTR     XFX4
554 0743C  29756 14007340      LDA     SYMSEL
555 0743E  29758 8C009472      SAM     BMSK1+46 CHECK IF SYMBOL 23 IS DESIRED
556 07440  29760 6006          JU      *+6
556 07441  29761     0700
557 07442  29762 64046CF2      JS      XYDOF
558 07444  29764 040072C4      PTR     XFX5
559 07446  29766 14007340      LDA     SYMSEL
560 07448  29768 8C009474      SAM     BMSK1+48 CHECK IF SYMBOL 24 IS DESIRED
561 0744A  29770 6006          JU      *+6
561 0744B  29771     0700
562 0744C  29772 64046CF2      JS      XYDOF
563 0744E  29774 040072D2      PTR     XFX6
564 07450  29776 14007340      LDA     SYMSEL
565 07452  29778 8C009476      SAM     BMSK1+50 CHECK IF SYMBOL 25 IS DESIRED
566 07454  29780 6006          JU      *+6
566 07455  29781     0700
567 07456  29782 64046CF2      JS      XYDOF
568 07458  29784 040072E0      PTR     XFX7
569 0745A  29786 14007340      LDA     SYMSEL
570 0745C  29788 8C009478      SAM     BMSK1+52 CHECK IF SYMBOL 26 IS DESIRED
571 0745E  29790 6006          JU      *+6
571 0745F  29791     0700
572 07460  29792 64046CF2      JS      XYDOF
573 07462  29794 040072EE      PTR     XFX8
574 07464  29796 14007340      LDA     SYMSEL
575 07466  29798 8C00947A      SAM     BMSK1+54 CHECK IF SYMBOL 27 IS DESIRED
576 07468  29800 6006          JU      *+6
576 07469  29801     0700
577 0746A  29802 64046CF2      JS      XYDOF
578 0746C  29804 040072FC      PTR     XFX9
579 0746E  29806 14007340      LDA     SYMSEL
580 07470  29808 8C00947C      SAM     BMSK1+56 CHECK IF SYMBOL 28 IS DESIRED
581 07472  29810 6006          JU      *+6
581 07473  29811     0700
582 07474  29812 64046CF2      JS      XYDOF
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LINE   ABS. ADDRESS INSTCODE SOURCE STATEMENT

583 07476  29814 0400730A         PTR     XFX10
584 07478  29816 14007340         LDA     SYMSEL
585 0747A  29818 8C00947E         SAM     BMSK1+58 CHECK IF SYMBOL 29 IS DESIRED
586 0747C  29820 6006             JU      *+6
586 0747D  29821      0700
587 0747E  29822 64046CF2         JS      XYDOF
588 07480  29824 04007318         PTR     XFX11
589 07482  29826 14007340         LDA     SYMSEL
590 07484  29828 8C009480         SAM     BMSK1+60 CHECK IF SYMBOL 30 IS DESIRED
591 07486  29830 6006             JU      *+6
591 07487  29831      0700
592 07488  29832 64046CF2         JS      XYDOF
593 0748A  29834 04007326         PTR     XFX12
594 0748C  29836 14007340         LDA     SYMSEL
595 0748E  29838 8C009482         SAM     BMSK1+62 CHECK IF SYMBOL 31 IS DESIRED
596 07490  29840 6006             JU      *+6
596 07491  29841      0700
597 07492  29842 64046432         JS      COMPASS
598 07494  29844 04007334         PTR     HDG
599 07496  29846 640474D6         JS      DMAOUT
600 07498  29848 6436716E         JGU     RETURN
601                          *
602                          *
603                          * TRGTBL -- ROUTINE TO GENERATE TABLES OF TRIG FUNCTIONS FOR USE BY THE
604                          *            REAL TIME SUBROUTINES
605 03E16  15894             ANG     EQU     TEMP+2
606 03E18  15896             ANGINC  EQU     TEMP+4
607 03E00  15872             SUBSTK  EQU     ARGLST   TEMP STORAGE FOR THE ROM TRIG SUBROUTINES
608                          *
609 0749A  29850 04007344 TRGTBL PTR     LOCRTN
610 0749C  29852 5C323E12         LDX     6,SUBSTK+18,M
611 0749E  29854 14020100         LDA     RL,M
612 074A0  29856 0480             CXF
613 074A1  29857      0700
613 074A2  29858 3C003E14         STA     TEMP
614 074A4  29860 14009498         LDA     PIOV4
615 074A6  29862 B4003E14         DVF     TEMP
616 074A8  29864 3C003E18         STA     ANGINC
617                          *
618 074AA  29866 5C420000         LDX     8,0,M
619 074AC  29868 14009484         LDA     FZERO
620 074AE  29870 3C003E16         STA     ANG
621 074B0  29872 3C409202         STA     TANTBL,8
622 074B2  29874 1400948A         LDA     ONE
623 074B4  29876 3C409000         STA     COSTBL,8
624                          *
625 074B6  29878 6C420002 LOOPCN IMP     8,2,M
626 074B8  29880 24430200         ICL     8,RLX2,M
627 074BA  29882 74007344         RTA     LOCRTN
628 074BC  29884 14003E16         LDA     ANG
629 074BE  29886 BC003E18         ADF     ANGINC
630 074C0  29888 3C003E16         STA     ANG
631 074C2  29890 64040444         JS      COSFA
632 074C4  29892 3C409000         STA     COSTBL,8
633 074C6  29894 14003E16         LDA     ANG
634 074C8  29896 64040718         JS      TANFA
635 074CA  29898 3C409202         STA     TANTBL,8
636 074CC  29900 6096             JU      LOOPCN
637                          *
638                          * ROUTINE TO OUTPUT THE TVRSTR TO THE DIGITAL TO VIDEO CONVERTER (DVC)
639                          *
640 074CD  29901      0700
640 074D6  29910             ORG     DMAOUT
641 074D6  29910 040074EA         PTR     DMARTN
642 074D8  29912 489B        TSTWCZ DIA     19,K
643 074D9  29913      0700
643 074DA  29914 8C020001         SAM     1,M
644 074DC  29916 6084             JU      TSTWCZ
644 074DD  29917      0700
645 074DE  29918 140074E8         LDA     WCCMP
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

646 074E0  29900 4B90            DOA     19,K
647 074E1  29921     0700
647 074E2  29922 14020001        LDA     1,M       HARDWARE CLEAR THE TVRSTR
648 074E4  29984 4A90            DOA     10,0,K
649 074E5  29925     0700
649 074E6  29926 740074EA        RTA     DMARTN
650 074E8  29928 8CF080D0 WOCMP  HEX     8CF080D0  * 1'S COMPLEMENT OF 1840 AND THE HALF WRD STRTING ADDR
651 074EA  29930          DMARTN BSS     2
652                       *
653                       * CLRSTR -- ROUTINE TO CLEAR THE TVRSTR
654 074EC  29932 04007344 CLRSTR PTR     LOCRTN
655 074EE  29934 34007FFE        LAE     TVRSTR-2
656 074F0  29936 0500            EAB
657 074F1  29937     0700
657 074F2  29938 14020000        LDA     0,M
658 074F4  29940 0680            LXA     0
659 074F5  29941     0700
659 074F6  29942 5C42000F        LDX     8,WPLX2-1,M
660 074F8  29944 5C220080        LDX     4,HRL,M
661 074FA  29946 2A00     LOOP1  MFM     0,4 *XFERS (WPLX2*HRL) FULL WRDS
662 074FB  29947     0700
662 074FC  29948 6C430001        IMN     8,1,M
663 074FE  29950 643074FA        JGU     LOOP1
664 07500  29952 74007344        RTA     LOCRTN
665                              END

    0 ERRORS
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  139                       * ATLINE -- ATTITUDE LINE ROLLED AN ANGLE FIIN AND PITCHED AN ANGLE PTCH
  140                       *
  141 06000  24576                    ORG     ATLINE
  142 06000  24576 0400949C           PTR     GLBRTN
  143 06002  24578 64306006           JGU     STRTPT
  144                       * STORAGE FOR ARGUMENTS XFERED INTO THIS ROUTINE
  145 03E00  15872          FIIN      EQU     ARGLST
  146 03E02  15874          THIN      EQU     ARGLST+2
  147 03E02  15874          PTCH      EQU     ARGLST+2
  148 06004  24580          LOCRTN    BSS     2
  149 06006  24582 5C60949C STRTPT    LDX     12,GLBRTN
  150 06008  24584 34640000           LAE     0,12,I
  151 0600A  24586 06E8               LXA     13
  152 0600B  24587                    0700
  152 0600C  24588 6C620002           IMP     12,2,M
  153 0600E  24590 1C60949C           STX     12,GLBRTN
  154 06010  24592 14680000           LDA     0,13
  155 06012  24594 3C003E00           STA     FIIN
  156 06014  24596 14680002           LDA     2,13      A REG CONTAINS THIN
  157                       * MAKE THE POSITIVE SENSE OF A PITCH CHANGE DEFLECT THE ATLINE DOWN
  158 06016  24598 9400948C           MLF     MONE
  159 06018  24600 3C003E02           STA     THIN
  160                       * SCALE FIIN OVER (PI/2) AND CONVERT IT TO A FX PT NUMBER (B0)
  161 0601A  24602 14003E00           LDA     FIIN
  162 0601C  24604 B4009496           DVF     PIOV2
  163 0601E  24606 54020000           LDB     0,M
  164 06020  24608 0400               CFX
  165 06021  24609      0C01          SRAD    1
  166 06022  24610 7C003F00           STB     FIIN
  167                       *
  168 06024  24612 5C6A000E           LDX     13,WPLX2-2,M   INITIALIZE WORD  COLUMN REG
  169 06026  24614 5C62003E           LDX     12,BPWX2-2,M   INITIALIZE BIT MASK REG
  170 06028  24616 14003E00           LDA     FIIN  (B0 FX PT)
  171 0602A  24618 54020000           LDB     0,M
  172 0602C  24620 66206040           JG      FIPOS
  173                       *
  174 0602E  24622 CC009486 FINEG     FXO     ONES  CONV FIIN TO A (+) FX PT NO.
  175 06030  24624 A4009404           ADU     IONE
  176 06032  24626 3C003E00           STA     FIIN
  177 06034  24628 8C009446           SAM     XHALF
  178 06036  24630 64306044           JU      CASE3  FIIN > (-PI/4)
  179 06038  24632 14009428 CASE4     LDA     PLUS1  FIIN < (-PI/4)
  180 0603A  24634 E4003E00           SBU     FIIN
  181 0603C  24636 84046064           JS      TANFX  COMP TRIG TBL INDEX AND FX PT TAN
  182 0603E  24638 14003E02           LDA     PTCH
  183 06040  24640 662061AC           JG      CASE4A  PTCH > 0
  184 06042  24642 6430621E           JGU     CASE4B  PTCH < 0
  185                       *
  186 06044  24644 84046064 CASE3     JS      TANFX  COMP TRIG TBL INDEX AND FX PT TAN
  187 06046  24646 14003E02           LDA     PTCH
  188 06048  24648 662060F2           JG      CASE3A  PTCH > 0
  189 0604A  24650 6430614E           JGU     CASE3B  PTCH < 0
  190                       *
  191 0604C  24652 8C009446 FIPOS     SAM     XHALF
  192 0604E  24654 600E               JU      CASE1  FIIN < (PI/4)
  192 0604F  24655      0700
  193 06050  24656 14009488 CASE2     LDA     PLUS1
  194 06052  24658 E4003E00           SBU     FIIN  *(PI/2 - FIIN)
  195 06054  24660 84046064           JS      TANFX  COMP TRIG TBL INDEX AND FX PT TAN
  196 06056  24662 14003E02           LDA     PTCH
  197 06058  24664 6620617A           JG      CASE2A  PTCH > 0
  198 0605A  24666 643061E4           JGU     CASE2B  PTCH < 0
  199                       *
  200 0605C  24668 84046064 CASE1     JS      TANFX  COMP TRIG TBL INDEX AND FX PT TAN
  201 0605E  24670 14003E02           LDA     PTCH
  202 06060  24672 6266               JG      CASE1A  PTCH > 0
  203 06061  24673      0700
  203 06062  24674 64306120           JGU     CASE1B  PTCH < 0
  204                       *
  205                       *
  206                       *
  207                       *ROUTINE TO COMPUTE AND LOAD THE TRIG TABLE INDEX INTO XR4 AND ALSO TO
  208                       * COMPUTE THE FX PT (B0) TAN( ). THE ROUTINE ASSUMES THAT THE ARGUMENT (B0) FOR
  209                       * THE TAN IS IN THE A REG. THE FX PT TANGENT IS STORED IN TANFNC.
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

210 06064  24676 04006004 TANFX  PTR     LOCRTN
211 06066  24678 0500             EAB
212 06067  24679      080A       SLLD    LGRL+2
213 06068  24680 0841             SLL     1
214 06069  24681      06A0       LXA     4  XR4 = TRIG TABLE INDEX
215 0606A  24682 16009202         LDA     TANTBL,4
216 0606C  24684 54020000         LDB     0,M
217 0606E  24686 0400             CFX
218 0606F  24687      0C01       SRAD    1
219 06070  24688 7C00949A         STB     TANFNC
220 06072  24690 74006004         RTA     LOCRTN
221                         *
222                         * D1 --   1.0 + TAN( ) - PTCH/COS( )
223                         * THIS ROUTINE ASSUMES PTCH IS IN THE A REG AND XR4 CONTAINS THE TRIG TBL INDEX
224                         * THE ROUTINE RETURNS WITH THE FX PT (B31) VALUE IN THE B REG.
225 06074  24692 04006004 D1       PTR     LOCRTN
226 06076  24694 B6009000         DVF     COSTBL,4
227 06078  24696 3C003E14         STA     TEMP
228 0607A  24698 1400948A         LDA     ONE         =1.0
229 0607C  24700 BE009202         ADF     TANTBL,4    =1.0 + TAN( )
230 0607E  24702 FC003E14         SBF     TEMP        =1.0 + TAN( ) -PTCH/COS( )
231 06080  24704 54020000         LDB     0,M
232 06082  24706 0400             CFX
233 06083  24707      0C01       SRAD    1          =(1.0 + TAN() -PTCH/COS())/2.0  FX PT
234 06084  24708 67206088         JL      OVRNG      TEST FOR OVERRANGE
235 06086  24710 74006004         RTA     LOCRTN
236 06088  24712 7400949C OVRNG   RTA     GLBRTN
237                         *
238                         * D2 --   1.0 - TAN( ) - PTCH/COS( )
239                         * THIS ROUTINE ASSUMES PTCH IS IN THE A REG AND XR4 CONTAINS THE TRIG TBL INDEX
240                         * THE ROUTINE RETURNS WITH THE FX PT (B31) VALUE IN THE B REG.
241 0608A  24714 04006004 D2       PTR     LOCRTN
242 0608C  24716 B6009000         DVF     COSTBL,4
243 0608E  24718 3C003E14         STA     TEMP
244 06090  24720 1400948A         LDA     ONE         =1.0
245 06092  24722 FE009202         SBF     TANTBL,4    =1.0 - TAN( )
246 06094  24724 FC003E14         SBF     TEMP        =1.0 - TAN( ) -PTCH/COS( )
247 06096  24726 54020000         LDB     0,M
248 06098  24728 0400             CFX
249 06099  24729      0C01       SRAD    1          =(1.0 - TAN() -PTCH/COS())/2.0  FX PT
250 0609A  24730 65206088         JN      OVRNG      TEST FOR OVERRANGE
251 0609C  24732 74006004         RTA     LOCRTN
252                         *
253                         * D3 --   1.0 - TAN( ) + PTCH/COS( )
254                         * THIS ROUTINE ASSUMES PTCH IS IN THE A REG AND XR4 CONTAINS THE TRIG TBL INDEX
255                         * THE ROUTINE RETURNS WITH THE FX PT (B31) VALUE IN THE B REG.
256 0609E  24734 04006004 D3       PTR     LOCRTN
257 060A0  24736 B6009000         DVF     COSTBL,4
258 060A2  24738 3C003E14         STA     TEMP
259 060A4  24740 1400948A         LDA     ONE         =1.0
260 060A6  24742 FE009202         SBF     TANTBL,4    =1.0 - TAN( )
261 060A8  24744 BC003E14         ADF     TEMP        =1.0 - TAN( ) +PTCH/COS( )
262 060AA  24746 54020000         LDB     0,M
263 060AC  24748 0400             CFX
264 060AD  24749      0C01       SRAD    1          =(1.0 - TAN() +PTCH/COS())/2.0  FX PT
265 060AE  24750 65206088         JN      OVRNG      TEST FOR OVERRANGE
266 060B0  24752 74006004         RTA     LOCRTN
267                         *
268                         * D4 --   1.0 + TAN( ) + PTCH/COS( )
269                         * THIS ROUTINE ASSUMES PTCH IS IN THE A REG AND XR4 CONTAINS THE TRIG TBL INDEX
270                         * THE ROUTINE RETURNS WITH THE FX PT (B31) VALUE IN THE B REG.
271 060B2  24754 04006004 D4       PTR     LOCRTN
272 060B4  24756 B6009000         DVF     COSTBL,4
273 060B6  24758 3C003E14         STA     TEMP
274 060B8  24760 1400948A         LDA     ONE         =1.0
275 060BA  24762 BE009202         ADF     TANTBL,4    =1.0 + TAN( )
276 060BC  24764 BC003E14         ADF     TEMP        =1.0 + TAN( ) +PTCH/COS( )
277 060BE  24766 54020000         LDB     0,M
278 060C0  24768 0400             CFX
279 060C1  24769      0C01       SRAD    1          =(1.0 + TAN() +PTCH/COS())/2.0  FX PT
280 060C2  24770 67206088         JL      OVRNG      TEST FOR OVERRANGE
```

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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

281 060C4  24772 74006004         RTA     LOCRTN
282                         *
283 060C6  24774 64046074 CASE1A  JS      D1
284 060C8  24776 0808             SLLD    LGRL
285 060C9  24777      0844        SLL     LGWPL+1
286 060CA  24778 06C0             LXA     8  XR8 CONTAINS STRTING RASTER WRD NO.
287 060CB  24779      0700
287 060CC  24780 14020000         LDA     0,M
288 060CE  24782 0500      LINE1A EAB
289 060CF  24783      0700
289 060D0  24784 14408000         LDA     TVRSTR,8
290 060D2  24786 C4609404         LOR     BMSK0,12
291 060D4  24788 3C408000         STA     TVRSTR,8
292 060D6  24790 0500             EAB
293 060D7  24791      0700
293 060D8  24792 A400949A         ADU     TANFNC
294 060DA  24794 662060E4         JG      LOC1A
295 060DC  24796 84009488         AND     PLUS1
296 060DE  24798 6C430010         IMN     8,WPLX2,M
297 060E0  24800 643060E4         JU      LOC1A
298 060E2  24802 7400949C         RTA     GLBRTN
299 060E4  24804 6C630002 LOC1A   IMN     12,2,M
300 060E6  24806 643060CE         JU      LINE1A
301 060E8  24808 5C62003E TST1A   LDX     12,BPWX2-2,M
302 060EA  24810 6C420002         IMP     8,2,M
303 060EC  24812 6C6B0002         IMN     13,2,M
304 060EE  24814 643060CE         JU      LINE1A
305 060F0  24816 7400949C         RTA     GLBRTN
306                         *
307                         * CASE3A --  (-PI/4) < FIIN < 0  , PTCH > 0
308                         *
309 060F2  24818 64046074 CASE3A  JS      D1
310 060F4  24820 0808             SLLD    LGRL
311 060F5  24821      0844        SLL     LGWPL+1
312 060F6  24822 06C0             LXA     8  XR8 CONTAINS STRTING RASTER WRD NO.
313 060F7  24823      0700
313 060F8  24824 6C42000E         IMP     8,WPLX2-2,M
314 060FA  24826 14020000         LDA     0,M
315 060FC  24828 0500      LINE3A EAB
316 060FD  24829      0700
316 060FE  24830 14408000         LDA     TVRSTR,8
317 06100  24832 C4609444         LOR     BMSK1,12
318 06102  24834 3C408000         STA     TVRSTR,8
319 06104  24836 0500             EAB
320 06105  24837      0700
320 06106  24838 A400949A         ADU     TANFNC
321 06108  24840 66206112         JG      LOC3A
322 0610A  24842 84009488         AND     PLUS1
323 0610C  24844 6C430010         IMN     8,WPLX2,M
324 0610E  24846 64306112         JU      LOC3A
325 06110  24848 7400949C         RTA     GLBRTN
326 06112  24850 6C630002 LOC3A   IMN     12,2,M
327 06114  24852 643060FC         JU      LINE3A
328 06116  24854 5C62003E TST3A   LDX     12,BPWX2-2,M
329 06118  24856 6C430002         IMN     8,2,M
330 0611A  24858 6C6B0002         IMN     13,2,M
331 0611C  24860 643060FC         JU      LINE3A
332 0611E  24862 7400949C         RTA     GLBRTN
333                         *
334                         * CASE1B -- 0 < FIIN < PI/4  , PTCH< 0
335                         *
336 06120  24864 6404608A CASE1B  JS      D2
337 06122  24866 0808             SLLD    LGRL
338 06123  24867      0844        SLL     LGWPL+1
339 06124  24868 06C0             LXA     8  XR8 CONTAINS STRTING RASTER WRD NO.
340 06125  24869      0700
340 06126  24870 6C42000E         IMP     8,WPLX2-2,M
341 06128  24872 14020000         LDA     0,M
342 0612A  24874 0500      LINE1B EAB
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

 343 0612B  24875      0700
 343 0612C  24876 14408000         LDA     TVRSTR,8
 344 0612E  24878 C4609444         LOR     BMSK1,12
 345 06130  24880 3C408000         STA     TVRSTR,8
 346 06132  24882 0500             EAB
 347 06133  24883      0700
 347 06134  24884 A400949A         ADU     TANFNC
 348 06136  24886 66206140         JG      LOC1B
 349 06138  24888 84009488         AND     PLUS1
 350 0613A  24890 6C420010         IMP     8,WPLX2,M
 351 0613C  24892 24431000         ICL     8,RSTRW,M
 352 0613E  24894 7400949C         RTA     GLBRTN
 353 06140  24896 6C630002 LOC1B   IMN     12,2,M
 354 06142  24898 6430612A         JU      LINE1B
 355 06144  24900 5C62003E TST1B   LDX     12,BPWX2-2,M
 356 06146  24902 6C430002         IMN     8,2,M
 357 06148  24904 6C6B0002         IMN     13,2,M
 358 0614A  24906 6430612A         JU      LINE1B
 359 0614C  24908 7400949C         RTA     GLBRTN
 360                       *
 361                       * CASE3B -- (-PI/4) < FIIN < 0  , PTCH < 0
 362                       *
 363 0614E  24910 6404608A CASE3B  JS      D2
 364 06150  24912 0808             SLLD    LGPL
 365 06151  24913      0844       SLL     LGWPL+1
 366 06152  24914 06C0             LXA     8  XR8 CONTAINS STRTING RASTER WRD NO.
 367 06153  24915      0700
 367 06154  24916 14020000         LDA     0,M
 368 06156  24918 0500      LINE3B EAB
 369 06157  24919      0700
 369 06158  24920 14408000         LDA     TVRSTR,8
 370 0615A  24922 C4609404         LOR     BMSK0,12
 371 0615C  24924 3C408000         STA     TVRSTR,8
 372 0615E  24926 0500             EAB
 373 0615F  24927      0700
 373 06160  24928 A400949A         ADU     TANFNC
 374 06162  24930 6620616C         JG      LOC3B
 375 06164  24932 84009488         AND     PLUS1
 376 06166  24934 6C420010         IMP     8,WPLX2,M
 377 06168  24936 24431000         ICL     8,RSTRW,M
 378 0616A  24938 7400949C         RTA     GLBRTN
 379 0616C  24940 6C630002 LOC3B   IMN     12,2,M
 380 0616E  24942 64306156         JU      LINE3B
 381 06170  24944 5C62003E TST3B   LDX     12,BPWX2-2,M
 382 06172  24946 6C420002         IMP     8,2,M
 383 06174  24948 6C6B0002         IMN     13,2,M
 384 06176  24950 64306156         JU      LINE3B
 385 06178  24952 7400949C         RTA     GLBRTN
 386                       *
 387                       * CASE2A -- (PI/4) < FIIN < (PI/2)  , PTCH > 0
 388                       *
 389 0617A  24954 64046074 CASE2A  JS      D1
 390 0617C  24956 0803             SLLD    LGWPL
 391 0617D  24957      0841       SLL     1
 392 0617E  24958 06E8             LXA     13       XR13 CONTAINS STRTING WRD COLUMN
 393 0617F  24959      06C0       LXA     8  XR8 CONTAINS STRTING RASTER WRD NO.
 394 06180  24960 14020000         LDA     0,M
 395 06182  24962 0805             SLLD    LGBPW
 396 06183  24963      0841       SLL     1
 397 06184  24964 06E0             LXA     12  XR12 CONTAINS STRTING BIT MSK NO.
 398 06185  24965      0700
 398 06186  24966 14020000         LDA     0,M
 399 06188  24968 0500      LINE2A EAB
 400 06189  24969      0700
 400 0618A  24970 14408000         LDA     TVRSTR,8
 401 0618C  24972 C4609444         LOR     BMSK1,12
 402 0618E  24974 3C408000         STA     TVRSTR,8
 403 06190  24976 0500             EAB
 404 06191  24977      0700
 404 06192  24978 6C420010         IMP     8,WPLX2,M
 405 06194  24980 24431000         ICL     8,RSTRW,M
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

406 061961  24982 7400949C         RTA     GLBRTN
407 061981  24984 A400949A         ADU     TANFNC
408 0619A1  24986 66206188         JG      LINE2A
409 0619C1  24988 84009488         AND     PLUS1
410 0619E1  24990 6C630002         IMN     12,2,M
411 061A01  24992 64306188         JU      LINE2A
412 061A21  24994 5C62003E LOC2A   LDX     12,BPWX2-2,M
413 061A41  24996 6C430002         IMN     8,2,M
414 061A61  24998 6C6B0002         IMN     13,2,M
415 061A81  25000 64306188         JU      LINE2A
416 061AA1  25002 7400949C         RTA     GLBRTN
417                        *
418                        * CASE4A -- (-PI/2) < FIIN < (-PI/4)  , PTCH > 0
419                        *
420 061AC1  25004 6404609E CASE4A  JS      D3
421 061AE1  25006 0803             SLLD    LGWPL
422 061AF1  25007     0841         SLL     1
423 061B01  25008 3C003E14         STA     TEMP
424 061B21  25010 6C693E14         IMN     13,TEMP  XR13 CONTAINS STRTING WRD COLUMN
425 061B41  25012 06C0             LXA     8  XR8 CONTAINS STRTING RASTER WRD NO.
425 061B51  25013     0700
426 061B61  25014 14020000         LDA     0,M
427 061B81  25016 0805             SLLD    LQBPW
428 061B91  25017     0841         SLL     1
429 061BA1  25018 3C003E14         STA     TEMP+1
430 061BC1  25020 6C613E14         IMN     12,TEMP  XR12 CONTAINS THE STRTING BIT MSK NO.
431 061BE1  25022 14020000         LDA     0,M
432 061C01  25024 0500     LINE4A  EAB
433 061C11  25025     0700
433 061C21  25026 14408000         LDA     TVRSTR,8
434 061C41  25028 C4609404         LOR     BMSK0,12
435 061C61  25030 3C408000         STA     TVRSTR,8
436 061C81  25032 0500             EAB
437 061C91  25033     0700
437 061CA1  25034 6C420010         IMP     8,WPLX2,M
438 061CC1  25036 24431000         ICL     8,RSTRW,M
439 061CE1  25038 7400949C         RTA     GLBRTN
440 061D01  25040 A400949A         ADU     TANFNC
441 061D21  25042 66206100         JG      LINE4A
442 061D41  25044 84009488         AND     PLUS1
443 061D61  25046 6C630002         IMN     12,2,M
444 061D81  25048 643061C0         JU      LINE4A
445 061DA1  25050 5C62003E LOC4A   LDX     12,BPWX2-2,M
446 061DC1  25052 6C420002         IMP     8,2,M
447 061DE1  25054 6C6B0002         IMN     13,2,M
448 061E01  25056 643061C0         JU      LINE4A
449 061E21  25058 7400949C         RTA     GLBRTN
450                        *
451                        * CASE2B -- (PI/4) < FIIN < (PI/2)  , PTCH < 0
452                        *
453 061E41  25060 6404608A CASE2B  JS      D2
454 061E61  25062 0803             SLLD    LGWPL
455 061E71  25063     0841         SLL     1
456 061E81  25064 3C003E14         STA     TEMP
457 061EA1  25066 6C693E14         IMN     13,TEMP  XR13 CONTAINS STRTING WRD COLUMN
458 061EC1  25068 06C0             LXA     8  XR8 CONTAINS STRTING RASTER WRD NO.
458 061ED1  25069     0700
459 061EE1  25070 6C420FF0         IMP     8,RSTRW-WPLX2,M
460 061F01  25072 14020000         LDA     0,M
461 061F21  25074 0805             SLLD    LQBPW
462 061F31  25075     0841         SLL     1
463 061F41  25076 3C003E14         STA     TEMP
464 061F61  25078 6C613E14         IMN     12,TEMP
465 061F81  25080 14020000         LDA     0,M
466 061FA1  25082 0500     LINE2B  EAB
467 061FB1  25083     0700
467 061FC1  25084 14408000         LDA     TVRSTR,8
468 061FE1  25086 C4609404         LOR     BMSK0,12
469 062001  25088 3C408000         STA     TVRSTR,8
470 062021  25090 0500             EAB
471 062031  25091     0700
471 062041  25092 6C430010         IMN     8,WPLX2,M
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FOCAP-S V10.03 PAGE   6
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT


472 06206  25094 6430620A         JU      LOC2B
473 06208  25096 7400949C         RTA     GLBRTN
474 0620A  25098 A400949A LOC2B   ADU     TANFNC
475 0620C  25100 662061FA         JG      LINE2B
476 0620E  25102 84009488         AND     PLUS1
477 06210  25104 6C630002         IMN     12,2,M
478 06212  25106 643061FA         JU      LINE2B
479 06214  25108 5C62003E TST2B   LDX     12,BPWX2-2,M
480 06216  25110 6C420002         IMP     8,2,M
481 06218  25112 6C6B0002         IMN     13,2,M
482 0621A  25114 643061FA         JU      LINE2B
483 0621C  25116 7400949C         RTA     GLBRTN
484                       *
485                       * CASE4B -- (-PI/2) < FIIN (-PI/4)  , PTCH < 0
486                       *
487 0621E  25118 640460B2 CASE4B  JS      D4
488 06220  25120 0803             SLLD    LGWPL
489 06221  25121      0841       SLL     1
490 06222  25122 06E8             LXA     13       XR13 CONTAINS STRTING WRD COLUMN
491 06223  25123      06C0       LXA     8
492 06224  25124 6C420FF0         IMP     8,RSTRW-WPLX2,M
493 06226  25126 14020000         LDA     0,M
494 06228  25128 0805             SLLD    LGBPW
495 06229  25129      0841       SLL     1
496 0622A  25130 06E0             LXA     12
497 0622B  25131      0700
497 0622C  25132 14020000         LDA     0,M
498 0622E  25134 0500     LINE4B  EAB
499 0622F  25135      0700
499 06230  25136 14403000         LDA     TVRSTR,8
500 06232  25138 C4609444         LOR     BMSK1,12
501 06234  25140 3C403000         STA     TVRSTR,8
502 06236  25142 0500             EAB
503 06237  25143      0700
503 06238  25144 6C430010         IMN     8,WPLX2,M
504 0623A  25146 6004             JU      LOC4B
504 0623B  25147      0700
505 0623C  25148 7400949C         RTA     GLBRTN
506 0623E  25150 A400949A LOC4B   ADU     TANFNC
507 06240  25152 6292             JG      LINE4B
508 06241  25153      0700
508 06242  25154 84009488         AND     PLUS1
509 06244  25156 6C630002         IMN     12,2,M
510 06246  25158 6098             JU      LINE4B
510 06247  25159      0700
511 06248  25160 5C62003E TST4B   LDX     12,BPWX2-2,M
512 0624A  25162 6C430002         IMN     8,2,M
513 0624C  25164 6C6B0002         IMN     13,2,M
514 0624E  25166 60A0             JU      LINE4B
514 0624F  25167      0700
515 06250  25168 7400949C         RTA     GLBRTN
516                               END

  0 ERRORS
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FOCAP-S V10.03 PAGE   1
LINE  ABS.  ADDRESS INSTCODE SOURCE STATEMENT

  139                       * VECTOR SYMBOL -- PROVIDES A STRAIGHT LINE SEGMENT BEGINNING AT P1(X1,Y1) AND
  140                       *                  TERMINATING ON P2(X2,Y2). THE COORDINATES OF BOTH
  141                       *                  POINTS ARE ASSUMED TO BE SCALED TO A MAXIMUM OF 1.0
  142 06252  25170                    ORG     VECTOR
  143 06252  25170 0400949C           PTR     GLBRTN
  144 06254  25172 64306250           JGU     STRTPT
  145                       * STORAGE FOR ARGUMENTS XFERED INTO THIS ROUTINE
  146 0000A     10           NARGX2 SETD    10       THE NO. OF ARGUMENTS (TIMES 2) TO BE XFERED
  147 03E00  15872           X1      EQU     ARGLST
  148 03E02  15874           Y1      EQU     ARGLST+2
  149 03E04  15876           X2      EQU     ARGLST+4
  150 03E06  15878           Y2      EQU     ARGLST+6
  151 03E08  15880           MARGIN  EQU     ARGLST+8
  152 03E0A  15882           XI      EQU     ARGLST+10
  153 03E0C  15884           YI      EQU     ARGLST+12
  154 06256  25174           LOCRTN  BSS     2
  155 06258  25176 6C430010 VINST   IMN     8,WPLX2,M
  156 0625A  25178 6C420010          IMP     8,WPLX2,M
  157                       *
  158 0625C  25180 5C60949C STRTPT  LDX     12,GLBRTN
  159 0625E  25182 34640000          LAE     0,12,I
  160 06260  25184 06E8              LXA     13
  161 06261  25185    0700
  161 06262  25186 6C620002          IMP     12,2,M
  162 06264  25188 1C60949C          STX     12,GLBRTN
  163                       * TRANSFER THE ARGUMENTS
  164 06266  25190 5C220008          LDX     4,NARGX2-2,M
  165 06268  25192 16680000 XFER    LDA     0,4,13
  166 0626A  25194 3E003E00          STA     ARGLST,4
  167 0626C  25196 6C230002          IMN     4,2,M
  168 0626E  25198 6086              JU      XFER
  168 0626F  25199    0700
  169                       *
  170                       *
  171                       * LIMIT THE INPUT POINT COORDINATES X1,Y1, X2, Y2, TO A MAXIMUM ABS VALUE OF 1.
  172 06270  25200 5C220006          LDX     4,6,M
  173 06272  25202 16003E00 LMNT    LDA     ARGLST,4
  174 06274  25204 64046372          JS      LIMIT
  175 06276  25206 3E003F00          STA     ARGLST,4
  176 06278  25208 6C230002          IMN     4,2,M
  177 0627A  25210 6088              JU      LMNT
  177 0627B  25211    0700
  178                       *
  179                       * FORM Y2-Y1 = YI AND X2-X1 = XI AND DETERMINE THE QUADRANT, WITH RESPECT
  180                       *  TO P1(X1,Y1), THAT THE VECTOR IS TO BE PLACED.
  181 0627C  25212 14003E06          LDA     Y2
  182 0627E  25214 FC003E02          SBF     Y1
  183 06280  25216 3C003E0C          STA     YI
  184 06282  25218 14003E04          LDA     X2
  185 06284  25220 FC003E00          SBF     X1
  186 06286  25222 3C003E0A          STA     XI
  187 06288  25224 54003E0C          LDB     YI        A REG = X2-X1 ,B REG = Y2-Y1
  188                       *
  189 0628A  25226 630A              JL      XINEG
  190 0628B  25227    0500           EAB             YI IN A
  191 0628C  25228 6720830C          JL      QUAD4
  192 0628E  25230 0500              EAB             XI IN A
  193 0628F  25231    6109           JN      QUAD1
  194 06290  25232 0500              EAB             YI IN A
  195 06291  25233    6107           JN      QUAD1
  196 06292  25234 74009490          RTA     GLBRTN    XI =0 ,YI = 0, (SPECIAL CASE)
  197 06294  25236 0500      XINEG   EAB             YI IN A
  198 06295  25237    6345           JL      QUAD3
  199 06296  25238 6020              JU      QUAD2
  200                       *
  201                       * QUADRANT 1 -- XI >= 0, YI >= 0
  202 06297  25239    0700
  202 06298  25240 14003E0A QUAD1   LDA     XI
  203 0629A  25242 FC003E0C          SBF     YI
  204 0629C  25244 630E              JL      CASE2
  205                       * CASE 1 -- XI>= YI
```

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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

206 0629D  25245      0700
206 0629E  25246 54003E0A CASE1  LDB      XI         PUT DENOMINATOR IN B
207 062A0  25248 14003E0C        LDA      YI         PUT NUMERATOR IN A
208 062A2  25250 64046334        JS       MISCAL     COMPUTE TANFNC, PERFORM LIMITING, SET UP INDEX REG
209 062A4  25252 14006258        LDA      VINST
210 062A6  25254 3C0063AC        STA      VINST1     CHANGE INST IN VECTR1 ROUTINE
211 062A8  25256 64306390        JGU      VECTR1
212                              * CASE2 -- XI< YI
213 062AA  25258 54003E0C CASE2  LDB      YI         PUT DENOMINATOR IN B
214 062AC  25260 14003E0A        LDA      XI         PUT NUMERATOR IN A
215 062AE  25262 64046334        JS       MISCAL
216 062B0  25264 14006258        LDA      VINST
217 062B2  25266 3C0063C6        STA      VINST2     CHANGE INST IN VECTR2 ROUTINE
218 062B4  25268 643063B8        JGU      VECTR2
219                              *
220                              * QUADRANT 2 -- XI< 0 , YI >= 0
221 062B6  25270 14003E0C QUAD2  LDA      YI
222 062B8  25272 BC003E0A        ADF      XI
223 062BA  25274 6310            JL       CASE4
224                              * CASE3 -- MAG(XI) < YI
225 062BB  25275      0700
225 062BC  25276 14003E0A CASE3  LDA      XI
226 062BE  25278 9400948C        MLF      MONE       NUMERATOR IN A
227 062C0  25280 54003E0C        LDB      YI         DENOMINATOR IN B
228 062C2  25282 64046334        JS       MISCAL
229 062C4  25284 14006258        LDA      VINST
230 062C6  25286 3C0063EC        STA      VINST3     CHANGE INST IN VECTR3 ROUTINE
231 062C8  25288 643063E0        JGU      VECTR3
232                              * CASE4 -- MAG(XI) > YI
233 062CA  25290 14003E0A CASE4  LDA      XI
234 062CC  25292 9400948C        MLF      MONE
235 062CE  25294 0500            EAB                 DENOMINATOR IN B
236 062CF  25295      0700
236 062D0  25296 14003E0C        LDA      YI         NUMERATOR IN A
237 062D2  25298 64046334        JS       MISCAL
238 062D4  25300 14006258        LDA      VINST
239 062D6  25302 3C006420        STA      VINST4     CHANGE INST IN VECTR4 ROUTINE
240 062D8  25304 64306406        JGU      VECTR4
241                              *
242                              * QUADRANT 3 -- XI < 0, YI < 0
243 062DA  25306 14003E0C QUAD3  LDA      YI
244 062DC  25308 FC003E0A        SBF      XI
245 062DE  25310 6318            JL       CASE6
246                              * CASE5 -- MAG(XI) > MAG(YI)
247 062DF  25311      0700
247 062E0  25312 14003E0C CASE5  LDA      YI
248 062E2  25314 9400948C        MLF      MONE
249 062E4  25316 3C003E14        STA      TEMP
250 062E6  25318 14003E0A        LDA      XI
251 062E8  25320 9400948C        MLF      MONE
252 062EA  25322 0500            EAB                 DENOMINATOR IN B
253 062EB  25323      0700
253 062EC  25324 14003E14        LDA      TEMP       NUMERATOR IN A
254 062EE  25326 64046334        JS       MISCAL
255 062F0  25328 1400625A        LDA      VINST+2
256 062F2  25330 3C006420        STA      VINST4     CHANGE INST IN VECTR4 ROUTINE
257 062F4  25332 64306406        JGU      VECTR4
258                              * CASE6 -- MAG(XI) < MAG(YI)
259 062F6  25334 14003E0A CASE6  LDA      XI
260 062F8  25336 9400948C        MLF      MONE
261 062FA  25338 3C003E14        STA      TEMP
262 062FC  25340 14003E0C        LDA      YI
263 062FE  25342 9400948C        MLF      MONE
264 06300  25344 0500            EAB                 DENOMINATOR IN B
265 06301  25345      0700
265 06302  25346 14003E14        LDA      TEMP       NUMERATOR IN A
266 06304  25348 64046334        JS       MISCAL
267 06306  25350 1400625A        LDA      VINST+2
268 06308  25352 3C0063EC        STA      VINST3     CHANGE INST IN VECTR3 ROUTINE
269 0630A  25354 643063E0        JGU      VECTR3
270                              *
```

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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

271                         *
272                         * QUADRANT 4 -- XI >= 0, YI < 0
273 06300  25356 14003E0C QUAD4  LDA     YI
274 06302  25358 BC003E0A        ADF     XI
275 06304  25360 6314            JL      CASE7
276                         * CASE8 -- XI > MAG(YI)
277 06306  25361     0700
277 06307  25362 14003E0C CASE8  LDA     YI
278 06309  25364 94009480       MLF     MONE
279 0630B  25366 0500            EAB
280 0630C  25367     0700
280 0630D  25368 14003E0A        LDA     XI
281 0630F  25370 0500            EAB                 DENOMINATOR IN B, NUMERATOR IN A
282 06310  25371     0700
282 06311  25372 64046334       JS      MISCAL
283 06313  25374 1400625A       LDA     VINST2
284 06315  25376 3C00633C       STA     VINST1      CHANGE INST IN VECTR1 ROUTINE
285 06317  25378 64306390       JGU     VECTR1
286                         * CASE 7 -- XI < MAG(YI)
287 06319  25380 14003E0C CASE7  LDA     YI
288 0631B  25382 94009480       MLF     MONE
289 0631D  25384 0500            EAB                 DENOMINATOR IN B
290 0631E  25385     0700
290 0631F  25386 14003E0A        LDA     XI          NUMERATOR IN A
291 06321  25388 64046334       JS      MISCAL
292 06323  25390 1400625A       LDA     VINST2
293 06325  25392 3C0063C6       STA     VINST2      CHANGE INST IN VECTR2 ROUTINE
294 06327  25394 643063B8       JGU     VECTR2
295                         *
296                         * MISCAL -- MISCELLANEOUS CALCULATIONS THAT PERFORM THE FOLLOWING:
297                         *           (1) COMPUTES THE TANENC
298                         *           (2) INITIALIZES XR9 TO THE INTEGER LENGTH OF THE VECTOR
299                         *           (3) INITIALIZES XR8 TO THE STARTING WORD WITHIN THE TVRSTR
300                         *           (4) STORES THE STARTING BIT WITHIN THE TVRSTR WORD IN TEMP+4
301                         *           THIS ROUTINE ASSUMES THAT THE B REG = DENOMINATOR AND THE
302                         *           A REG = NUMERATOR.
303 06329  25396 04006256 MISCAL PTR     LOCATN
304 0632B  25398 7C003E14        STB     TEMP
305 0632D  25400 54020000        LDB     0,M
306 0632F  25402 B4003E14        DVF     TEMP
307 06331  25404 0400            CFX
308 06332  25405     0C01        SRAD    1
309 06334  25406 7C009496       STB     TANENC
310 06336  25408 14009492       LDA     F128
311 06338  25410 54020000        LDB     0,M
312 0633A  25412 FC003E08       SBF     MARGIN
313 0633C  25414 3C003E16       STA     TEMP+2
314 0633E  25416 94003E14       MLF     TEMP
315 06340  25418 54020000        LDB     0,M
316 06342  25420 0400            CFX
317 06343  25421     06C8        LXA     9
318 06344  25422 14003E16       LDA     TEMP+2
319 06346  25424 94003E02       MLF     Y1
320 06348  25426 94009480       MLF     MONE
321 0634A  25428 BC009492       ADF     F128
322 0634C  25430 0400            CFX
323 0634D  25431     0844        SLL     4
324 0634E  25432 06C0            LXA     8           XR8 = STARTING RASTER LINE
325 06350  25433     0700
325 06351  25434 14003E16       LDA     TEMP+2
326 06353  25436 94003E00       MLF     X1
327 06355  25438 BC009492       ADF     F128
328 06357  25440 0400            CFX
329 06358  25441     0700
329 06359  25442 54020000        LDB     0,M
330 0635B  25444 0C05            SRAD    5
331 0635C  25445     0841        SLL     1
332 0635D  25446 3C003E14       STA     TEMP
333 0635F  25448 6C403E14       IMP     8,TEMP      XR8 = STARTING WORD NO.
334 06361  25450 14020000        LDA     0,M
335 06363  25452 0805            SLLD    5
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

336 0636D  25453      0700 obvi
336 0636E  25454 3C003E18        STA     TEMP+4   TEMP+4 = STARTING BIT NO. COUNTING FROM MSB
337 06370  25456 74006256        RTA     LOCRTN
338                              *
339                              * LIMIT -- LIMITING ROUTINE, ASSUMES A REG CONTAINS FLOATING POINT VARIABLE
340                              *  TO BE LIMITED.
341 06372  25458 04006256 LIMIT   PTR     LOCRTN
342 06374  25460 3C003E14        STA     TEMP
343 06376  25462 620E            JG      PLOC
344 06377  25463      0700
344 06378  25464 FC00948C        SBF     MONE
345 0637A  25466 6306            JL      NEGLIM
346 0637B  25467      0700
346 0637C  25468 14003E14        LDA     TEMP
347 0637E  25470 74006256        RTA     LOCRTN
348 06380  25472 14009480 NEGLIM LDA     MONE
349 06382  25474 74006256        RTA     LOCRTN
350 06384  25476 FC009488 PLOC   SBF     ONE
351 06386  25478 6206            JG      POSLIM
352 06387  25479      0700
352 06388  25480 14003E14        LDA     TEMP
353 0638A  25482 74006256        RTA     LOCRTN
354 0638C  25484 14009488 POSLIM LDA     ONE
355 0638E  25486 74006256        RTA     LOCRTN
356                              *
357                              * VECTR1  - VECTOR ROUTINE 1, USED FOR CASE1 AND CASE8.
358 06390  25488 5C62003E VECTR1 LDX     12,BPWX2-2,M  INITIALIZE BIT MASK CTR
359 06392  25490 6C613E18        IMN     12,TEMP+4
360 06394  25492 14020000        LDA     0,M
361 06396  25494 0500      V1LOOP EAB
362 06397  25495      0700
362 06398  25496 14408000        LDA     TVRSTR,8
363 0639A  25498 C4609404        LOR     BMSK0,12
364 0639C  25500 3C408000        STA     TVRSTR,8
365 0639E  25502 6C4B0001        IMN     9,1,M
366 063A0  25504 6004            JU      LOC1
366 063A1  25505      0700
367 063A2  25506 74009490        RTA     GLBRTN
368 063A4  25508 0500      LOC1  EAB
369 063A5  25509      0700
369 063A6  25510 A400949A        ADU     TANFNC
370 063A8  25512 6206            JG      LOC1A
371 063A9  25513      0700
371 063AA  25514 84009488        AND     PLUS1
372 063AC  25516 6C430010 VINST1 IMN     8,WPLX2,M
373 063AE  25518 6C630002 LOC1A  IMN     12,2,M
374 063B0  25520 609A            JU      V1LOOP
374 063B1  25521      0700
375 063B2  25522 5C62003E        LDX     12,BPWX2-2,M
376 063B4  25524 6C420002        IMN     8,2,M
377 063B6  25526 6000            JU      V1LOOP
378                              *
379                              * VECTR2 -- VECTOR ROUTINE 2, USED FOR CASE2 AND CASE7.
380 063B7  25527      0700
380 063B8  25528 5C62003E VECTR2 LDX     12,BPWX2-2,M
381 063BA  25530 6C613E18        IMN     12,TEMP+4
382 063BC  25532 14020000        LDA     0,M
383 063BE  25534 0500      V2LOOP EAB
384 063BF  25535      0700
384 063C0  25536 14408000        LDA     TVRSTR,8
385 063C2  25538 C4609404        LOR     BMSK0,12
386 063C4  25540 3C408000        STA     TVRSTR,8
387 063C6  25542 6C430010 VINST2 IMN     8,WPLX2,M
388 063C8  25544 6C4B0001        IMN     9,1,M
389 063CA  25546 6004            JU      LOC2
389 063CB  25547      0700
390 063CC  25548 74009490        RTA     GLBRTN
391 063CE  25550 0500      LOC2  EAB
392 063CF  25551      0700
392 063D0  25552 A400949A        ADU     TANFNC
393 063D2  25554 6294            JG      V2LOOP
394 063D3  25555      0700
394 063D4  25556 84009488        AND     PLUS1
395 063D6  25558 6C630002        IMN     12,2,M
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT


396 063D3  25560 609A            JU      V2LOOP
396 063D9  25561      0700
397 063DA  25562 5C62003E        LDX     12,BPWX2-2,M
398 063DC  25564 6C420002        IMN     8,2,M
399 063DE  25566 60A0            JU      V2LOOP
400                              *
401                              * VECTR3 -- VECTOR ROUTINE 3, USED FOR CASE3 AND CASE6.
402 063DF  25567      0700
402 063E0  25568 5C603E18 VECTR3 LDX     12,TEMP+4
403 063E2  25570 14020000        LDA     0,M
404 063E4  25572 0500     V3LOOP EAB
405 063E5  25573      0700
405 063E6  25574 14408000        LDA     TVRSTR,8
406 063E8  25576 C4609444        LOR     BMSK1,12
407 063EA  25578 30408000        STA     TVRSTR,8
408 063EC  25580 6C420010 VINST3 IMN     8,WPLX2,M
409 063EE  25582 6C4B0001        IMN     9,1,M
410 063F0  25584 6004            JU      LOC3
410 063F1  25585      0700
411 063F2  25586 74009490        RTA     GLBRTN
412 063F4  25588 0500     LOC3   EAB
413 063F5  25589      0700
413 063F6  25590 A4009498        ADU     TANFNC
414 063F8  25592 6294            JG      V3LOOP
415 063F9  25593      0700
415 063FA  25594 84009488        AND     PLUS1
416 063FC  25596 6C630002        IMN     12,2,M
417 063FE  25598 609A            JU      V3LOOP
417 063FF  25599      0700
418 06400  25600 5C62003E        LDX     12,BPWX2-2,M
419 06402  25602 6C430002        IMN     8,2,M
420 06404  25604 60A0            JU      V3LOOP
420 06405  25605      0700
421                              *
422                              * VECTR4 -- VECTOR ROUTINE 4, USED FOR CASE4 AND CASE5.
423 06406  25606 5C603E18 VECTR4 LDX     12,TEMP+4
424 06408  25608 14020000        LDA     0,M
425 0640A  25610 0500     V4LOOP EAB
426 0640B  25611      0700
426 0640C  25612 14408000        LDA     TVRSTR,8
427 0640E  25614 C4609444        LOR     BMSK1,12
428 06410  25616 30408000        STA     TVRSTR,8
429 06412  25618 6C4B0001        IMN     9,1,M
430 06414  25620 6004            JU      LOC4
430 06415  25621      0700
431 06416  25622 74009490        RTA     GLBRTN
432 06418  25624 0500     LOC4   EAB
433 06419  25625      0700
433 0641A  25626 A4009498        ADU     TANFNC
434 0641C  25628 6206            JG      LOC4A
435 0641D  25629      0700
435 0641E  25630 84009488        AND     PLUS1
436 06420  25632 6C430010 VINST4 IMN     8,WPLX2,M
437 06422  25634 6C630002 LOC4A  IMN     12,2,M
438 06424  25636 609A            JU      V4LOOP
438 06425  25637      0700
439 06426  25638 5C62003E        LDX     12,BPWX2-2,M
440 06428  25640 6C430002        IMN     8,2,M
441 0642A  25642 60A0            JU      V4LOOP
441 0642B  25643      0700
442                              END


  0 ERRORS
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  139                       * AIRSPD -- ROUTINE TO GENERATE A VERTICALLY MOVING AIRSPEED TAPE
  140                       *
  141 00008      8          NARGX2 SETD    8        THE NO. OF ARGUMENTS (TIMES 2) TO BE XFERED
  142 067D4  26580                 ORG     AIRSPD
  143 067D4  26580 0400949C        PTR     GLBRTN
  144 067D6  26582 64306A50        JGU     STRTPT
  145                       * STORAGE FOR XFER OF ARGUMENTS INTO THE ROUTINE
  146 03E00  15872          ASPD   EQU     ARGLST
  147 03E02  15874          SCLGTH EQU     ARGLST+2
  148 03E04  15876          REMKSA EQU     ARGLST+4
  149 03E06  15878          SCLSA  EQU     ARGLST+6
  150 067D8  26584 00000000 ASPDIN DEC     0
  151 067DA  26586 40E66666 RLPKT  DEC     1.6      NO. OF RASTER LINES PER KNOT
  152 067DC  26588 80000000 MSB    HEX     80000000
  153                       * STORAGE AREA FOR THE REFERENCE MARK DOT ARRAY
  154 067DE  26590 FE000000 ASREMK HEX     FE000000
  155                       * STORAGE AREA FOR THE AIRSPEED TAPE DOT ARRAY
  156 067E0  26592 00055550        HEX     00055550
  157 067E2  26594 00055550        HEX     00055550
  158 067E4  26596 00055550        HEX     00055550
  159 067E6  26598 00055550        HEX     00055550
  160 067E8  26600 00055550        HEX     00055550
  161 067EA  26602 00055550        HEX     00055550
  162 067EC  26604 00055550        HEX     00055550
  163 067EE  26606 00055550        HEX     00055550
  164 067F0  26608 00055550        HEX     00055550
  165 067F2  26610 00055550        HEX     00055550
  166 067F4  26612 00055550        HEX     00055550
  167 067F6  26614 00055550        HEX     00055550
  168 067F8  26616 00055550        HEX     00055550
  169 067FA  26618 00055550        HEX     00055550
  170 067FC  26620 00055550        HEX     00055550
  171 067FE  26622 00055550        HEX     00055550
  172 06800  26624 00055550        HEX     00055550
  173 06802  26626 000208E0        HEX     000208E0
  174 06804  26628 00061910        HEX     00061910
  175 06806  26630 00022910        HEX     00022910
  176 06808  26632 00F24910        HEX     00F24910
  177 0680A  26634 00027D10        HEX     00027D10
  178 0680C  26636 00020910        HEX     00020910
  179 0680E  26638 000708E0        HEX     000708E0
  180 06810  26640 00000300        HEX     0
  181 06812  26642 00000000        HEX     0
  182 06814  26644 00000000        HEX     0
  183 06816  26646 00000000        HEX     0
  184 06818  26648 00FE0000        HEX     00FE0000
  185 0681A  26650 00000000        HEX     0
  186 0681C  26652 00000000        HEX     0
  187 0681E  26654 00000000        HEX     0
  188 06820  26656 00000000        HEX     0
  189 06822  26658 000238E0        HEX     000238E0
  190 06824  26660 00064510        HEX     00064510
  191 06826  26662 00020510        HEX     00020510
  192 06828  26664 00F21910        HEX     00F21910
  193 0682A  26666 00020510        HEX     00020510
  194 0682C  26668 00024510        HEX     00024510
  195 0682E  26670 000738E0        HEX     000738E0
  196 06830  26672 00000000        HEX     0
  197 06832  26674 00000000        HEX     0
  198 06834  26676 00000000        HEX     0
  199 06836  26678 00000000        HEX     0
  200 06838  26680 00FE0000        HEX     00FE0000
  201 0683A  26682 00000000        HEX     0
  202 0683C  26684 00000000        HEX     0
  203 0683E  26686 00000000        HEX     0
  204 06840  26688 00000000        HEX     0
  205 06842  26690 000238E0        HEX     000238E0
  206 06844  26692 00064510        HEX     00064510
  207 06846  26694 00020510        HEX     00020510
  208 06848  26696 00F20910        HEX     00F20910
  209 0684A  26698 00021110        HEX     00021110
  210 0684C  26700 00022110        HEX     00022110
```

```
.INE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

211 0684E  26702 00077CE0        HEX     00077CE0
212 06850  26704 00000000        HEX     0
213 06852  26706 00000000        HEX     0
214 06854  26708 00000000        HEX     0
215 06856  26710 00000000        HEX     0
216 06858  26712 00FE0000        HEX     00FE0000
217 0685A  26714 00000000        HEX     0
218 0685C  26716 00000000        HEX     0
219 0685E  26718 00000000        HEX     0
220 06860  26720 00000000        HEX     0
221 06862  26722 000210E0        HEX     000210E0
222 06864  26724 00063110        HEX     00063110
223 06866  26726 00021110        HEX     00021110
224 06868  26728 00F21110        HEX     00F21110
225 0686A  26730 00021110        HEX     00021110
226 0686C  26732 00021110        HEX     00021110
227 0686E  26734 000738E0        HEX     000738E0
228 06870  26736 00000000        HEX     0
229 06872  26738 00000000        HEX     0
230 06874  26740 00000000        HEX     0
231 06876  26742 00000000        HEX     0
232 06878  26744 00FE0000        HEX     00FE0000
233 0687A  26746 00000000        HEX     0
234 0687C  26748 00000000        HEX     0
235 0687E  26750 00000000        HEX     0
236 06880  26752 00000000        HEX     0
237 06882  26754 000238E0        HEX     000238E0
238 06884  26756 00064510        HEX     00064510
239 06886  26758 00024510        HEX     00024510
240 06888  26760 00F24510        HEX     00F24510
241 0688A  26762 00024510        HEX     00024510
242 0688C  26764 00024510        HEX     00024510
243 0688E  26766 000738E0        HEX     000738E0
244 06890  26768 00000000        HEX     0
245 06892  26770 00000000        HEX     0
246 06894  26772 00000000        HEX     0
247 06896  26774 00000000        HEX     0
248 06898  26776 00FE0000        HEX     00FE0000
249 0689A  26778 00000000        HEX     0
250 0689C  26780 00000000        HEX     0
251 0689E  26782 00000000        HEX     0
252 068A0  26784 00000000        HEX     0
253 068A2  26786 00038E00        HEX     00038E00
254 068A4  26788 00045100        HEX     00045100
255 068A6  26790 00045100        HEX     00045100
256 068A8  26792 00F3D100        HEX     00F3D100
257 068AA  26794 00005100        HEX     00005100
258 068AC  26796 00045100        HEX     00045100
259 068AE  26798 00038E00        HEX     00038E00
260 068B0  26800 00000000        HEX     0
261 068B2  26802 00000000        HEX     0
262 068B4  26804 00000000        HEX     0
263 068B6  26806 00000000        HEX     0
264 068B8  26808 00FE0000        HEX     00FE0000
265 068BA  26810 00000000        HEX     0
266 068BC  26812 00000000        HEX     0
267 068BE  26814 00000000        HEX     0
268 068C0  26816 00000000        HEX     0
269 068C2  26818 00038E00        HEX     00038E00
270 068C4  26820 00045100        HEX     00045100
271 068C6  26822 00045100        HEX     00045100
272 068C8  26824 00F39100        HEX     00F39100
273 068CA  26826 00045100        HEX     00045100
274 068CC  26828 00045100        HEX     00045100
275 068CE  26830 00038E00        HEX     00038E00
276 068D0  26832 00000000        HEX     0
277 068D2  26834 00000000        HEX     0
278 068D4  26836 00000000        HEX     0
279 068D6  26838 00000000        HEX     0
280 068D8  26840 00FE0000        HEX     00FE0000
```

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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

281 068DA  26842 00000000        HEX     0
282 068DC  26844 00000000        HEX     0
283 068DE  26846 00000000        HEX     0
284 068E0  26848 00000000        HEX     0
285 068E2  26850 0007CE00        HEX     0007CE00
286 068E4  26852 00005100        HEX     00005100
287 068E6  26854 00009100        HEX     00009100
288 068E8  26856 00F11100        HEX     00F11100
289 068EA  26858 00011100        HEX     00011100
290 068EC  26860 00021100        HEX     00021100
291 068EE  26862 00020E00        HEX     00020E00
292 068F0  26864 00000000        HEX     0
293 068F2  26866 00000000        HEX     0
294 068F4  26868 00000000        HEX     0
295 068F6  26870 00000000        HEX     0
296 068F8  26872 00FE0000        HEX     00FE0000
297 068FA  26874 00000000        HEX     0
298 068FC  26876 00000000        HEX     0
299 068FE  26878 00000000        HEX     0
300 06900  26880 00000000        HEX     0
301 06902  26882 00038E00        HEX     00038E00
302 06904  26884 00045100        HEX     00045100
303 06906  26886 00041100        HEX     00041100
304 06908  26888 00F59100        HEX     00F59100
305 0690A  26890 00065100        HEX     00065100
306 0690C  26892 00045100        HEX     00045100
307 0690E  26894 00038E00        HEX     00038E00
308 06910  26896 00000000        HEX     0
309 06912  26898 00000000        HEX     0
310 06914  26900 00000000        HEX     0
311 06916  26902 00000000        HEX     0
312 06918  26904 00FE0000        HEX     00FE0000
313 0691A  26906 00000000        HEX     0
314 0691C  26908 00000000        HEX     0
315 0691E  26910 00000000        HEX     0
316 06920  26912 00000000        HEX     0
317 06922  26914 0007CE00        HEX     0007CE00
318 06924  26916 00041100        HEX     00041100
319 06926  26918 00041100        HEX     00041100
320 06928  26920 00F79100        HEX     00F79100
321 0692A  26922 00005100        HEX     00005100
322 0692C  26924 00005100        HEX     00005100
323 0692E  26926 00078E00        HEX     00078E00
324 06930  26928 00000000        HEX     0
325 06932  26930 00000000        HEX     0
326 06934  26932 00000000        HEX     0
327 06936  26934 00000000        HEX     0
328 06938  26936 00FE0000        HEX     00FE0000
329 0693A  26938 00000000        HEX     0
330 0693C  26940 00000000        HEX     0
331 0693E  26942 00000000        HEX     0
332 06940  26944 00000000        HEX     0
333 06942  26946 00008E00        HEX     00008E00
334 06944  26948 00019100        HEX     00019100
335 06946  26950 00029100        HEX     00029100
336 06948  26952 00F49100        HEX     00F49100
337 0694A  26954 0007D100        HEX     0007D100
338 0694C  26956 00009100        HEX     00009100
339 0694E  26958 00008E00        HEX     00008E00
340 06950  26960 00000000        HEX     0
341 06952  26962 00000000        HEX     0
342 06954  26964 00000000        HEX     0
343 06956  26966 00000000        HEX     0
344 06958  26968 00FE0000        HEX     00FE0000
345 0695A  26970 00000000        HEX     0
346 0695C  26972 00000000        HEX     0
347 0695E  26974 00000000        HEX     0
348 06960  26976 00000000        HEX     0
349 06962  26978 00038E00        HEX     00038E00
350 06964  26980 00045100        HEX     00045100
```

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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

351 06966  26982 00005100         HEX      00005100
352 06968  26984 00F19100         HEX      00F19100
353 0696A  26986 00005100         HEX      00005100
354 0696C  26988 00045100         HEX      00045100
355 0696E  26990 00038E00         HEX      00038E00
356 06970  26992 00000000         HEX      0
357 06972  26994 00000000         HEX      0
358 06974  26996 00000000         HEX      0
359 06976  26998 00000000         HEX      0
360 06978  27000 00FE0000         HEX      00FE0000
361 0697A  27002 00000000         HEX      0
362 0697C  27004 00000000         HEX      0
363 0697E  27006 00000000         HEX      0
364 06980  27008 00000000         HEX      0
365 06982  27010 00038E00         HEX      00038E00
366 06984  27012 00045100         HEX      00045100
367 06986  27014 00005100         HEX      00005100
368 06988  27016 00F09100         HEX      00F09100
369 0698A  27018 00011100         HEX      00011100
370 0698C  27020 00021100         HEX      00021100
371 0698E  27022 0007CE00         HEX      0007CE00
372 06990  27024 00000000         HEX      0
373 06992  27026 00000000         HEX      0
374 06994  27028 00000000         HEX      0
375 06996  27030 00000000         HEX      0
376 06998  27032 00FE0000         HEX      00FE0000
377 0699A  27034 00000000         HEX      0
378 0699C  27036 00000000         HEX      0
379 0699E  27038 00000000         HEX      0
380 069A0  27040 00000000         HEX      0
381 069A2  27042 00008E00         HEX      00008E00
382 069A4  27044 00019100         HEX      00019100
383 069A6  27046 00009100         HEX      00009100
384 069A8  27048 00F09100         HEX      00F09100
385 069AA  27050 00009100         HEX      00009100
386 069AC  27052 00009100         HEX      00009100
387 069AE  27054 0001CE00         HEX      0001CE00
388 069B0  27056 00000000         HEX      0
389 069B2  27058 00000000         HEX      0
390 069B4  27060 00000000         HEX      0
391 069B6  27062 00000000         HEX      0
392 069B8  27064 00FE0000         HEX      00FE0000
393 069BA  27066 00000000         HEX      0
394 069BC  27068 00000000         HEX      0
395 069BE  27070 00000000         HEX      0
396 069C0  27072 00000000         HEX      0
397 069C2  27074 00000E00         HEX      00000E00
398 069C4  27076 00001100         HEX      00001100
399 069C6  27078 00001100         HEX      00001100
400 069C8  27080 00F01100 ASSCL   HEX      00F01100
401 069CA  27082 00001100         HEX      00001100
402 069CC  27084 00001100         HEX      00001100
403 069CE  27086 00000E00         HEX      00000E00
404                    t
405 069D0  27088 00055500         HEX      00055500
406 069D2  27090 00055500         HEX      00055500
407 069D4  27092 00055500         HEX      00055500
408 069D6  27094 00055500         HEX      00055500
409 069D8  27096 00055500         HEX      00055500
410 069DA  27098 00055500         HEX      00055500
411 069DC  27100 00055500         HEX      00055500
412 069DE  27102 00055500         HEX      00055500
413 069E0  27104 00055500         HEX      00055500
414 069E2  27106 00055500         HEX      00055500
415 069E4  27108 00055500         HEX      00055500
416 069E6  27110 00055500         HEX      00055500
417 069E8  27112 00055500         HEX      00055500
418 069EA  27114 00055500         HEX      00055500
419 069EC  27116 00055500         HEX      00055500
420 069EE  27118 00055500         HEX      00055500
```

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FOCAP-S V10.03 PAGE   5
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

421 069F0  27120 00055500          HEX     00055500
422 069F2  27122 00055500          HEX     00055500
423 069F4  27124 00055500          HEX     00055500
424 069F6  27126 00055500          HEX     00055500
425 069F8  27128 00055500          HEX     00055500
426 069FA  27130 00055500          HEX     00055500
427 069FC  27132 00055500          HEX     00055500
428 069FE  27134 00055500          HEX     00055500
429 06A00  27136 00055500          HEX     00055500
430 06A02  27138 00055500          HEX     00055500
431 06A04  27140 00055500          HEX     00055500
432 06A06  27142 00055500          HEX     00055500
433 06A08  27144 00055500          HEX     00055500
434 06A0A  27146 00055500          HEX     00055500
435 06A0C  27148 00055500          HEX     00055500
436 06A0E  27150 00055500          HEX     00055500
437 06A10  27152 00055500          HEX     00055500
438 06A12  27154 00055500          HEX     00055500
439 06A14  27156 00055500          HEX     00055500
440 06A16  27158 00055500          HEX     00055500
441 06A18  27160 00055500          HEX     00055500
442 06A1A  27162 00055500          HEX     00055500
443 06A1C  27164 00055500          HEX     00055500
444 06A1E  27166 00055500          HEX     00055500
445 06A20  27168 00055500          HEX     00055500
446 06A22  27170 00055500          HEX     00055500
447 06A24  27172 00055500          HEX     00055500
448 06A26  27174 00055500          HEX     00055500
449 06A28  27176 00055500          HEX     00055500
450 06A2A  27178 00055500          HEX     00055500
451 06A2C  27180 00055500          HEX     00055500
452 06A2E  27182 00055500          HEX     00055500
453 06A30  27184 00055500          HEX     00055500
454 06A32  27186 00055500          HEX     00055500
455 06A34  27188 00055500          HEX     00055500
456 06A36  27190 00055500          HEX     00055500
457 06A38  27192 00055500          HEX     00055500
458 06A3A  27194 00055500          HEX     00055500
459 06A3C  27196 00055500          HEX     00055500
460 06A3E  27198 00055500          HEX     00055500
461 06A40  27200 00055500          HEX     00055500
462 06A42  27202 00055500          HEX     00055500
463 06A44  27204 00055500          HEX     00055500
464 06A46  27206 00055500          HEX     00055500
465 06A48  27208 00055500          HEX     00055500
466 06A4A  27210 00055500          HEX     00055500
467 06A4C  27212 00055500          HEX     00055500
468 06A4E  27214 00055500          HEX     00055500
469                          *
470 06A50  27216 5C60940C STRTPT LDX     12,GLBRTN PUT ADDR OF JS+2 INTO XR12
471 06A52  27218 34640000        LAE     0,12,I   OBTAIN STRTING LOC OF THE ARGUMENT LIST
472 06A54  27220 06E8            LXA     13
473 06A55  27221      0700
473 06A56  27222 6C620002        IMP     12,2,M
474 06A58  27224 1C60940C        STX     12,GLBRTN MODIFY THE RETURN ADDR
475                          * TRANSFER THE ARGUMENTS
476 06A5A  27226 5C220006        LDX     4,NARGX2-2,M
477 06A5C  27228 16680000 XFER   LDA     0,4,13
478 06A5E  27230 3E003E00        STA     ARGLST,4
479 06A60  27232 6C230002        IMN     4,2,M
480 06A62  27234 64306A5C        JU      XFER
481                          *
482 06A64  27236 14003E00 STRT LDA       ASPD
483 06A66  27238 6304            JL      *+4
484 06A67  27239      0700
484 06A68  27240 3C0067D8        STA     ASPDIN
485 06A6A  27242 140067D8        LDA     ASPDIN
```

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FOCAP-S V10.03 PAGE   6
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT


486 06A6C  27244 940067DA         MLF     RLPKT
487 06A6E  27246 0400             CFX
488 06A6F  27247      0700
488 06A70  27248 AC0067DC         ADL     MSB
489 06A72  27250 A4020000         ADU     0,M
490 06A74  27252 0841             SLL     1
491 06A75  27253      0700
491 06A76  27254 A400?E02         ADU     SCLGTH
492 06A78  27256 3C003E14         STA     TEMP
493 06A7A  27258 340069C8         LAE     ASSCL
494 06A7C  27260 06C8             LXA     9
495 06A7D  27261      0700
495 06A7E  27262 6C493E14         IMN     9,TEMP    XR9 - ABS STRTING ADDR WITHIN ASSCL
496 06A80  27264 34008000         LAE     TVRSTR
497 06A82  27266 06C0             LXA     8
498 06A83  27267      0700
498 06A84  27268 6C403E06         IMP     8,SCLSA   INCREMENT TO THE SCALE STARTING ADDR
499 06A86  27270 6C803E02         LDX     4,SOLQTH
500 06A88  27272 6C230001         IMN     4,1,M
501 06A8A  27274 14009486         LDA     ONES
502 06A8C  27276 3C400000         STA     0,8
503 06A8E  27278 14480000 ASPDLP  LDA     0,9
504 06A90  27280 C4400000         LOP     0,8
505 06A92  27282 3C400000         STA     0,8
506 06A94  27284 6C4A0002         IMP     9,2,M
507 06A96  27286 6C420010         IMP     8,16,M
508 06A98  27288 6C230001         IMN     4,1,M
509 06A9A  27290 64306A8E         JU      ASPDLP
510 06A9C  27292 14009486         LDA     ONES
511 06A9E  27294 3C400000         STA     0,8
512 06AA0  27296 34002000         LAE     TVPSTR
513 06AA2  27298 06C0             LXA     8
514 06AA3  27299      0700
514 06AA4  27300 6C403E04         IMP     8,REMKSA
515 06AA6  27302 140067DE REFMK   LDA     ASREMK
516 06AA8  27304 C4400000         LOP     0,8
517 06AAA  27306 3C400000         STA     0,8
518 06AAC  27308 74009490         RTA     GLBRTN
519                               END


  0 ERRORS
```

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FOCAP-S V10.03 PAGE   1
LINE  ABS  ADDRESS INSTCODE SOURCE STATEMENT

  139                       * COMPASS -- SUBROUTINE TO GENERATE A HORIZONTALLY MOVING COMPASS TAPE
  140                       *
  141 00002      2          NARGX2 SETD    2        THE NO. OF ARGUMENTS (TIMES 2) TO BE XFERED
  142 06432  25650                 ORG     COMPASS
  143 06432  25650 0400949C        PTR     GLBRTN
  144 06434  25652 6430674A        JGU     STRTPT
  145                       * STORAGE FOR XFER OF ARGUMENTS INTO THE ROUTINE
  146 03E00  15872          HDG     EQU     ARGLST   SYMBOL  INPUT (FL. PT. MAX ABS VALUE = 360.0)
  147 03E14  15892          DSPL    EQU     TEMP
  148 03E16  15894          BDSPL   EQU     TEMP+2
  149 08100  33024          SCLPOS  EQU     TVRSTR+256
  150 06436  25654 00000000 HDGIN   DEC     0        STORAGE LOCATION FOR THE INPUT HEADING
  151 06438  25656 43400000 THRTY2  DEC     32.0
  152 0643A  25658 41599999 K1      DEC     2.8      NO. OF BITS/DEGREE
  153 0643C  25660 80000000 MSB     HEX     80000000
  154                       *
  155                       *
  156                       *
  157 0643E  25662 071C7000 HDGSCL  HEX     071C7000
  158 06440  25664 08A28800         HEX     08A28800
  159 06442  25666 00828800         HEX     00828800
  160 06444  25668 030C8820         HEX     030C8820
  161 06446  25670 00828820         HEX     00828820
  162 06448  25672 08A28820         HEX     08A28820
  163 0644A  25674 071C7020         HEX     071C7020
  164 0644C  25676 00000020         HEX     00000020
  165 0644E  25678 00080020         HEX     00080020
  166 06450  25680 00080020         HEX     00080020
  167                       *
  168 06452  25682 0003827C         HEX     0003827C
  169 06454  25684 00044640         HEX     00044640
  170 06456  25686 00004A40         HEX     00004A40
  171 06458  25688 00819278         HEX     00819278
  172 0645A  25690 00805E04         HEX     00805E04
  173 0645C  25692 00844204         HEX     00844204
  174 0645E  25694 00838278         HEX     00838278
  175 06460  25696 00800000         HEX     00800000
  176 06462  25698 00800200         HEX     00800200
  177 06464  25700 00800200         HEX     00800200
  178                       *
  179 06466  25702 00000002         HEX     00000002
  180 06468  25704 00000003         HEX     00000003
  181 0646A  25706 00000002         HEX     00000002
  182 0646C  25708 08002002         HEX     08002002
  183 0646E  25710 08002002         HEX     08002002
  184 06470  25712 08002002         HEX     08002002
  185 06472  25714 08002002         HEX     08002002
  186 06474  25716 08002000         HEX     08002000
  187 06476  25718 08002000         HEX     08002000
  188 06478  25720 08002000         HEX     08002000
  189                       *
  190 0647A  25722 20000000         HEX     20000000
  191 0647C  25724 20000000         HEX     20000000
  192 0647E  25726 A0000000         HEX     A0000000
  193 06480  25728 A0020008         HEX     A0020008
  194 06482  25730 60020008         HEX     60020008
  195 06484  25732 20020008         HEX     20020008
  196 06486  25734 20020008         HEX     20020008
  197 06488  25736 00020008         HEX     00020008
  198 0648A  25738 80020008         HEX     80020008
  199 0648C  25740 80020008         HEX     80020008
  200                       *
  201 0648E  25742 009F0000         HEX     009F0000
  202 06490  25744 01900000         HEX     01900000
  203 06492  25746 00900000         HEX     00900000
  204 06494  25748 009E0080         HEX     009E0080
  205 06496  25750 00810080         HEX     00810080
  206 06498  25752 00810080         HEX     00810080
  207 0649A  25754 01DE0080         HEX     01DE0080
  208 0649C  25756 00000080         HEX     00000080
  209 0649E  25758 00200080         HEX     00200080
  210 064A0  25760 00200080         HEX     00200080
```

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FOCAP-S V10.03 PAGE   2
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

211                              *
212 064A2  25762 0000E380        HEX     0000E380
213 064A4  25764 00011440        HEX     00011440
214 064A6  25766 00001440        HEX     00001440
215 064A8  25768 02006440        HEX     02006440
216 064AA  25770 02001440        HEX     02001440
217 064AC  25772 02011440        HEX     02011440
218 064AE  25774 0200E380        HEX     0200E380
219 064B0  25776 02000000        HEX     02000000
220 064B2  25778 02000800        HEX     02000800
221 064B4  25780 02000800        HEX     02000800
222                              *
223 064B6  25782 00000009        HEX     00000009
224 064B8  25784 00000019        HEX     00000019
225 064BA  25786 00000029        HEX     00000029
226 064BC  25788 20008049        HEX     20008049
227 064BE  25790 2000807C        HEX     2000807C
228 064C0  25792 20008008        HEX     20008008
229 064C2  25794 20008009        HEX     20008009
230 064C4  25796 20008000        HEX     20008000
231 064C6  25798 20008002        HEX     20008002
232 064C8  25800 20008002        HEX     20008002
233                              *
234 064CA  25802 F0000000        HEX     F0000000
235 064CC  25804 00000000        HEX     00000000
236 064CE  25806 00000000        HEX     00000000
237 064D0  25808 E0080020        HEX     E0080020
238 064D2  25810 10080020        HEX     10080020
239 064D4  25812 10080020        HEX     10080020
240 064D6  25814 E0080020        HEX     E0080020
241 064D8  25816 00080020        HEX     00080020
242 064DA  25818 00080020        HEX     00080020
243 064DC  25820 00080020        HEX     00080020
244                              *
245 064DE  25822 0E380000        HEX     0E380000
246 064E0  25824 11440000        HEX     11440000
247 064E2  25826 10440000        HEX     10440000
248 064E4  25828 16440200        HEX     16440200
249 064E6  25830 19440200        HEX     19440200
250 064E8  25832 11440200        HEX     11440200
251 064EA  25834 0E380200        HEX     0E380200
252 064EC  25836 00000200        HEX     00000200
253 064EE  25838 00800200        HEX     00800200
254 064F0  25840 00800200        HEX     00800200
255                              *
256 064F2  25842 0007DF00        HEX     0007DF00
257 064F4  25844 00005000        HEX     00005000
258 064F6  25846 00009000        HEX     00009000
259 064F8  25848 08011E00        HEX     08011E00
260 064FA  25850 08010100        HEX     08010100
261 064FC  25852 08020100        HEX     08020100
262 064FE  25854 08021E00        HEX     08021E00
263 06500  25856 08000000        HEX     08000000
264 06502  25858 08002000        HEX     08002000
265 06504  25860 08002000        HEX     08002000
266                              *
267 06506  25862 0000003E        HEX     0000003E
268 06508  25864 00000020        HEX     00000020
269 0650A  25866 00000020        HEX     00000020
270 0650C  25868 80020038        HEX     80020038
271 0650E  25870 80020020        HEX     80020020
272 06510  25872 80020020        HEX     80020020
273 06512  25874 8002003E        HEX     8002003E
274 06514  25876 80020000        HEX     80020000
275 06516  25878 80020008        HEX     80020008
276 06518  25880 80020008        HEX     80020008
277                              *
278 0651A  25882 00000000        HEX     00000000
279 0651C  25884 00000000        HEX     00000000
280 0651E  25886 00000000        HEX     00000000
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FOCAP-S V10.03 PAGE   3
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

281 06520  25888 00200080        HEX     00200080
282 06522  25890 00200080        HEX     00200080
283 06524  25892 00200080        HEX     00200080
284 06526  25894 00200080        HEX     00200080
285 06528  25896 00200080        HEX     00200080
286 0652A  25898 00200080        HEX     00200080
287 0652C  25900 00200080        HEX     00200080
288                         *
289 0652E  25902 473E0000        HEX     473E0000
290 06530  25904 C8A00000        HEX     C8A00000
291 06532  25906 48A00000        HEX     48A00000
292 06534  25908 48BC0800        HEX     48BC0800
293 06536  25910 48820800        HEX     48820800
294 06538  25912 48820800        HEX     48820800
295 0653A  25914 E73C0800        HEX     E73C0800
296 0653C  25916 00000800        HEX     00000800
297 0653E  25918 02000800        HEX     02000800
298 06540  25920 02000800        HEX     02000800
299                         *
300 06542  25922 0011C700        HEX     0011C700
301 06544  25924 00322880        HEX     00322880
302 06546  25926 00102880        HEX     00102880
303 06548  25928 20104882        HEX     20104882
304 0654A  25930 20108882        HEX     20108882
305 0654C  25932 20110882        HEX     20110882
306 0654E  25934 203BE702        HEX     203BE702
307 06550  25936 20000002        HEX     20000002
308 06552  25938 20008002        HEX     20008002
309 06554  25940 20008002        HEX     20008002
310                         *
311 06556  25942 00000473        HEX     00000473
312 06558  25944 00000C8A        HEX     00000C8A
313 0655A  25946 0000040A        HEX     0000040A
314 0655C  25948 00080433        HEX     00080433
315 0655E  25950 00080408        HEX     00080408
316 06560  25952 00080488        HEX     00080488
317 06562  25954 00080E73        HEX     00080E73
318 06564  25956 00080000        HEX     00080000
319 06566  25958 00080020        HEX     00080020
320 06568  25960 00080020        HEX     00080020
321                         *
322 0656A  25962 E0000001        HEX     E0000001
323 0656C  25964 00000003        HEX     00000003
324 0656E  25966 00000001        HEX     00000001
325 06570  25968 C0800201        HEX     C0800201
326 06572  25970 20800201        HEX     20800201
327 06574  25972 20800201        HEX     20800201
328 06576  25974 C0800203        HEX     C0800203
329 06578  25976 00800200        HEX     00800200
330 0657A  25978 00800200        HEX     00800200
331 0657C  25980 00800200        HEX     00800200
332                         *
333 0657E  25982 3E700000        HEX     3E700000
334 06580  25984 20880000        HEX     20880000
335 06582  25986 20880000        HEX     20880000
336 06584  25988 3C882000        HEX     3C882000
337 06586  25990 02882000        HEX     02882000
338 06588  25992 02882000        HEX     02882000
339 0658A  25994 BC702000        HEX     BC702000
340 0658C  25996 00002000        HEX     00002000
341 0658E  25998 08002000        HEX     08002000
342 06590  26000 08002000        HEX     08002000
343                         *
344 06592  26002 00473E00        HEX     00473E00
345 06594  26004 00C8A000        HEX     00C8A000
346 06596  26006 00482000        HEX     00482000
347 06598  26008 804B3C08        HEX     804B3C08
348 0659A  26010 804C8208        HEX     804C8208
349 0659C  26012 80488208        HEX     80488208
350 0659E  26014 80E73C08        HEX     80E73C08
```

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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

351 065A0  26016 80000008        HEX     80000008
352 065A2  26018 80020008        HEX     80020008
353 065A4  26020 80020008        HEX     80020008
354                        *
355 065A6  26022 00001C0         HEX     00001C0
356 065A8  26024 00000220        HEX     00000220
357 065AA  26026 00000200        HEX     00000200
358 065AC  26028 00200100        HEX     00200100
359 065AE  26030 00200020        HEX     00200020
360 065B0  26032 00200220        HEX     00200220
361 065B2  26034 00200100        HEX     00200100
362 065B4  26036 00200000        HEX     00200000
363 065B6  26038 00200080        HEX     00200080
364 065B8  26040 00200080        HEX     00200080
365                        *
366 065BA  26042 00000004        HEX     00000004
367 065BC  26044 0000000C        HEX     0000000C
368 065BE  26046 00000004        HEX     00000004
369 065C0  26048 02000804        HEX     02000804
370 065C2  26050 02000804        HEX     02000804
371 065C4  26052 02000804        HEX     02000804
372 065C6  26054 0200080E        HEX     0200080E
373 065C8  26056 02000800        HEX     02000800
374 065CA  26058 02000800        HEX     02000800
375 065CC  26060 02000800        HEX     02000800
376                        *
377 065CE  26062 73E00000        HEX     73E00000
378 065D0  26064 8A000000        HEX     8A000000
379 065D2  26066 8A000000        HEX     8A000000
380 065D4  26068 7BC08002        HEX     7BC08002
381 065D6  26070 08208002        HEX     08208002
382 065D8  26072 88208002        HEX     88208002
383 065DA  26074 73C08002        HEX     73C08002
384 065DC  26076 00008002        HEX     00008002
385 065DE  26078 20008002        HEX     20008002
386 065E0  26080 20008002        HEX     20008002
387                        *
388 065E2  26082 0388E000        HEX     0388E000
389 065E4  26084 04591000        HEX     04591000
390 065E6  26086 00491000        HEX     00491000
391 065E8  26088 00891020        HEX     00891020
392 065EA  26090 01091020        HEX     01091020
393 065EC  26092 02091020        HEX     02091020
394 065EE  26094 07DCE020        HEX     07DCE020
395 065F0  26096 00000020        HEX     00000020
396 065F2  26098 00080020        HEX     00080020
397 065F4  26100 00080020        HEX     00080020
398                        *
399 065F6  26102 0001C73E        HEX     0001C73E
400 065F8  26104 000228A0        HEX     000228A0
401 065FA  26106 000020A0        HEX     000020A0
402 065FC  26108 0080413C        HEX     0080413C
403 065FE  26110 00808202        HEX     00808202
404 06600  26112 00810402        HEX     00810402
405 06602  26114 0083EFBC        HEX     0083EFBC
406 06604  26116 00800000        HEX     00800000
407 06606  26118 00800200        HEX     00800200
408 06608  26120 00800200        HEX     00800200
409                        *
410 0660A  26122 000000E0        HEX     000000E0
411 0660C  26124 00000111        HEX     00000111
412 0660E  26126 00000012        HEX     00000012
413 06610  26128 08002024        HEX     08002024
414 06612  26130 08002047        HEX     08002047
415 06614  26132 08002080        HEX     08002080
416 06616  26134 080021F0        HEX     080021F0
417 06618  26136 08002000        HEX     08002000
418 0661A  26138 08002000        HEX     08002000
419 0661C  26140 08002000        HEX     08002000
420                        *
```

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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

421 0661E  26142 8E000000        HEX     8E000000
422 06620  26144 91000000        HEX     91000000
423 06622  26146 91000000        HEX     91000000
424 06624  26148 91020008        HEX     91020008
425 06626  26150 D1020008        HEX     D1020008
426 06628  26152 91020008        HEX     91020008
427 0662A  26154 8E020008        HEX     8E020008
428 0662C  26156 00020008        HEX     00020008
429 0662E  26158 80020008        HEX     80020008
430 06630  26160 80020008        HEX     80020008
431                         *
432 06632  26162 1CFBE000        HEX     1CFBE000
433 06634  26164 22820000        HEX     22820000
434 06636  26166 02820000        HEX     02820000
435 06638  26168 04F3C080        HEX     04F3C080
436 0663A  26170 08082080        HEX     08082080
437 0663C  26172 10082080        HEX     10082080
438 0663E  26174 3EF3C080        HEX     3EF3C080
439 06640  26176 00000080        HEX     00000080
440 06642  26178 00200080        HEX     00200080
441 06644  26180 00200080        HEX     00200080
442                         *
443 06646  26182 00002200        HEX     00002200
444 06648  26184 00002200        HEX     00002200
445 0664A  26186 00002200        HEX     00002200
446 0664C  26188 02002A00        HEX     02002A00
447 0664E  26190 02002A00        HEX     02002A00
448 06650  26192 02003600        HEX     02003600
449 06652  26194 02001400        HEX     02001400
450 06654  26196 02000000        HEX     02000000
451 06656  26198 02000800        HEX     02000800
452 06658  26200 02000800        HEX     02000800
453                         *
454 0665A  26202 00001C7         HEX     00001C7
455 0665C  26204 00000228        HEX     00000228
456 0665E  26206 00000028        HEX     00000028
457 06660  26208 20008047        HEX     20008047
458 06662  26210 20008088        HEX     20008088
459 06664  26212 20008108        HEX     20008108
460 06666  26214 200083E7        HEX     200083E7
461 06668  26216 20008000        HEX     20008000
462 0666A  26218 20008002        HEX     20008002
463 0666C  26220 20008002        HEX     20008002
464                         *
465 0666E  26222 3E000000        HEX     3E000000
466 06670  26224 A0000000        HEX     A0000000
467 06672  26226 A0000000        HEX     A0000000
468 06674  26228 3C080020        HEX     3C080020
469 06676  26230 82080020        HEX     82080020
470 06678  26232 82080020        HEX     82080020
471 0667A  26234 3C080020        HEX     3C080020
472 0667C  26236 00080020        HEX     00080020
473 0667E  26238 00080020        HEX     00080020
474 06680  26240 00080020        HEX     00080020
475                         *
476 06682  26242 71C70000        HEX     71C70000
477 06684  26244 8A288000        HEX     8A288000
478 06686  26246 0A288000        HEX     0A288000
479 06688  26248 32288200        HEX     32288200
480 0668A  26250 0A288200        HEX     0A288200
481 0668C  26252 8A288200        HEX     8A288200
482 0668E  26254 71C70200        HEX     71C70200
483 06690  26256 00000200        HEX     00000200
484 06692  26258 00800200        HEX     00800200
485 06694  26260 00800200        HEX     00800200
486                         *
487 06696  26262 000E27C0        HEX     000E27C0
488 06698  26264 00116400        HEX     00116400
489 0669A  26266 00012400        HEX     00012400
490 0669C  26268 08062780        HEX     08062780
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

491 0669E  26270 08012040        HEX     08012040
492 066A0  26272 08112040        HEX     08112040
493 066A2  26274 080E7780        HEX     080E7780
494 066A4  26276 08000000        HEX     08000000
495 066A6  26278 08002000        HEX     08002000
496 066A8  26280 08002000        HEX     08002000
497                         *
498 066AA  26282 0000071C        HEX     0000071C
499 066AC  26284 000008A2        HEX     000008A2
500 066AE  26286 00000082        HEX     00000082
501 066B0  26288 8002030C        HEX     8002030C
502 066B2  26290 80020082        HEX     80020082
503 066B4  26292 800208A2        HEX     800208A2
504 066B6  26294 8002071C        HEX     8002071C
505 066B8  26296 80020000        HEX     80020000
506 066BA  26298 80020008        HEX     80020008
507 066BC  26300 80020008        HEX     80020008
508                         *
509 066BE  26302 70000003        HEX     70000003
510 066C0  26304 88000004        HEX     88000004
511 066C2  26306 88000000        HEX     88000000
512 066C4  26308 88200081        HEX     88200081
513 066C6  26310 88200080        HEX     88200080
514 066C8  26312 88200084        HEX     88200084
515 066CA  26314 70200083        HEX     70200083
516 066CC  26316 00200080        HEX     00200080
517 066CE  26318 00200080        HEX     00200080
518 066D0  26320 00200080        HEX     00200080
519                         *
520 066D2  26322 827C0000        HEX     827C0000
521 066D4  26324 46400000        HEX     46400000
522 066D6  26326 4A400000        HEX     4A400000
523 066D8  26328 92780800        HEX     92780800
524 066DA  26330 5F040800        HEX     5F040800
525 066DC  26332 42040800        HEX     42040800
526 066DE  26334 82780800        HEX     82780800
527 066E0  26336 00000800        HEX     00000800
528 066E2  26338 02000800        HEX     02000800
529 066E4  26340 02000800        HEX     02000800
530                         *
531 066E6  26342 00022000        HEX     00022000
532 066E8  26344 00032000        HEX     00032000
533 066EA  26346 0002A000        HEX     0002A000
534 066EC  26348 2002A002        HEX     2002A002
535 066EE  26350 20026002        HEX     20026002
536 066F0  26352 20022002        HEX     20022002
537 066F2  26354 20022002        HEX     20022002
538 066F4  26356 20000002        HEX     20000002
539 066F6  26358 20008002        HEX     20008002
540 066F8  26360 20008002        HEX     20008002
541                         *
542 066FA  26362 0000009F        HEX     0000009F
543 066FC  26364 00000190        HEX     00000190
544 066FE  26366 00000090        HEX     00000090
545 06700  26368 0008009E        HEX     0008009E
546 06702  26370 00080081        HEX     00080081
547 06704  26372 00080081        HEX     00080081
548 06706  26374 000801DE        HEX     000801DE
549 06708  26376 00080000        HEX     00080000
550 0670A  26378 00080020        HEX     00080020
551 0670C  26380 00080020        HEX     00080020
552                         *
553 0670E  26382 00000000        HEX     00000000
554 06710  26384 00000001        HEX     00000001
555 06712  26386 00000000        HEX     00000000
556 06714  26388 00800200        HEX     00800200
557 06716  26390 00800200        HEX     00800200
558 06718  26392 00800201        HEX     00800201
559 0671A  26394 00800200        HEX     00800200
560 0671C  26396 00800200        HEX     00800200
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FOCAP-S V10.03 PAGE   7
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

561 0671E  26398 00800200          HEX     00800200
562 06720  26400 00800200          HEX     00800200
563                          *
564 06722  26402 E3800000          HEX     E3800000
565 06724  26404 14400000          HEX     14400000
566 06726  26406 14400000          HEX     14400000
567 06728  26408 64402000          HEX     64402000
568 0672A  26410 14402000          HEX     14402000
569 0672C  26412 14402000          HEX     14402000
570 0672E  26414 E3802000          HEX     E3802000
571 06730  26416 00002000          HEX     00002000
572 06732  26418 08002000          HEX     08002000
573 06734  26420 08002000          HEX     08002000
574                          *
575 06736  26422 0009F000          HEX     0009F000
576 06738  26424 00190000          HEX     00190000
577 0673A  26426 00290000          HEX     00290000
578 0673C  26428 8049E008          HEX     8049E008
579 0673E  26430 807C1008          HEX     807C1008
580 06740  26432 80081008          HEX     80081008
581 06742  26434 8009E008          HEX     8009E008
582 06744  26436 20000008          HEX     20000008
583 06746  26438 80020008          HEX     80020008
584 06748  26440 80020008          HEX     80020008
585                          *
586                          *
587 0674A  26442 5C60949C STRTPT LDX     12,GLBRTN PUT ADDR OF JS+2 INTO XR12
588 0674C  26444 34640000        LAE     0,12,I   OBTAIN STRTING LOC OF THE ARGUMENT LIST
589 0674E  26446 06E8            LXA     13
590 0674F  26447      0700
590 06750  26448 6C620002        IMP     12,2,M
591 06752  26450 1C60949C        STX     12,GLBRTN MODIFY THE RETURN ADDR
592                          * TRANSFER THE ARGUMENTS
593 06754  26452 5C220000        LDX     4,NARGX2-2,M
594 06756  26454 16680000 XFER   LDA     0,4,13
595 06758  26456 3E003E00        STA     ARGLST,4
596 0675A  26458 6C230002        IMN     4,2,M
597 0675C  26460 6086            JU      XFER
597 0675D  26461      0700
598 0675E  26462 14003E00 STRT   LDA     HDG      HDG IN DEGREES FL. PT.  ( 0 <= HDG < 360 )
599 06760  26464 6304            JL      *+4      TST FOR NEGATIVE INPUT
600 06761  26465      0700
600 06762  26466 3C006436        STA     HDGIN
601 06764  26468 14006436        LDA     HDGIN
602 06766  26470 9400643A        MLF     K1
603 06768  26472 3C003E16        STA     BDSPL
604 0676A  26474 B4006438        DVF     THRTY2
605 0676C  26476 0400            CFX              A REG = NO. OF WHOLE WORDS DISPLACEMENT
606 0676D  26477      0700
606 0676E  26478 3C003E14        STA     DSPL
607 06770  26480 14020000        LDA     0,M
608 06772  26482 0805            SLLD    5
609 06773  26483      0700
609 06774  26484 AC00643C        ADL     MSB
610 06776  26486 A4020000        ADU     0,M
611 06778  26488 06A0            LXA     4
612 06779  26489      0700
612 0677A  26490 14003E14        LDA     DSPL
613 0677C  26492 D402000A        MUL     10,M
614 0677E  26494 0500            EAB
615 0677F  26495      06C8       LXA     9
616 06780  26496 5C420000        LDX     8,0,M
617                          * ROUTINE TO SHIFT AND TRANSFER THE HEADING SCALE INTO THE RASTER
618                          *   XR9 - THE STARTING WORD ACROSS THE STORED SCALE
619                          *   XR4 - SHIFT COUNT
```

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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

620                          *   XR8 - RASTER WORD COUNTER
621 06782  26498 1448643E SCLOOP LDA     HDGSCL,9
622 06784  26500 54486452        LDB     HDGSCL+20,9
623 06786  26502 0A00            SLLD    0,4
624 06787  26503      0700
624 06788  26504 C4408102        LOR     SCLPOS+2,8
625 0678A  26506 3C408102        STA     SCLPOS+2,8
626 0678C  26508 6C4A0002        IMP     9,2,M
627 0678E  26510 6C420010        IMP     8,16,M
628 06790  26512 244300A0        ICL     8,160,M
629 06792  26514 6004            JU      NXWC
629 06793  26515      0700
630 06794  26516 6092            JU      SCLOOP
631 06795  26517      0700
631 06796  26518 6C43009E NXWC    IMN     8,158,M
632 06798  26520 2443000C        ICL     8,12,M
633 0679A  26522 6004            JU      RFMK
633 0679B  26523      0700
634 0679C  26524 609A            JU      SCLOOP
635                          *
636 0679D  26525      0700
636 0679E  26526 5C420000 RFMK    LDX     8,0,M
637 067A0  26528 5C220000        LDX     4,12,M
638 067A2  26530 1400643C RFLOOP LDA     MSB
639 067A4  26532 C44081B8        LOR     SCLPOS+184,8
640 067A6  26534 3C4081B8        STA     SCLPOS+184,8
641 067A8  26536 6C420010        IMP     8,16,M
642 067AA  26538 6C230002        IMN     4,2,M
643 067AC  26540 608A            JU      RFLOOP
643 067AD  26541      0700
644 067AE  26542 7400949C        RTA     GLBRTN
645                              END


  0 ERRORS
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FOCAP-S V10.03 PAGE   1
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  139                       * VSCALE -- VERTICAL SCALE SUBROUTINE
  140                       *
  141 00008      8          NARGX2 SETD    8         THE NO. OF ARGUMENTS (TIMES 2) TO BE XFERED
  142 06AAE  27310                 ORG     VSCALE
  143 06AAE  27310 0400949C        PTR     GLBRTN
  144 06AB0  27312 64306AB6        JGU     STRTPT
  145                       * STORAGE FOR XFER OF ARGUMENTS INTO THE ROUTINE
  146 03E00  15872          HPOS   EQU     ARGLST    WRD COLUMN NO. OF HORIZONTAL POSITION OF SCALE
  147 03E02  15874          VSCLC  EQU     ARGLST+2  RASTER LINE NO. OF SCALE CENTER MARK
  148 03E04  15876          VSPC   EQU     ARGLST+4  NO. OF RASTER LINES BETWEEN SCALE DIVISIONS
  149 03E06  15878          VMRKS  EQU     ARGLST+6  TOTAL NO. OF SCALE MARKS, EXCLUDING CENTER MARK
  150                       *
  151 06AB2  27314 00FFFE00 LMARK  HEX     00FFFE00
  152 06AB4  27316 000FE000 SMARK  HEX     000FE000
  153                       *
  154 06AB6  27318 5C60949C STRTPT LDX     12,GLBRTN PUT ADDR OF JS+2 INTO XR12
  155 06AB8  27320 34640000        LAE     0,12,I    OBTAIN STRTING LOC OF THE ARGUMENT LIST
  156 06ABA  27322 06E8            LXA     13
  157 06ABB  27323      0700
  157 06ABC  27324 6C620002        IMP     12,2,M
  158 06ABE  27326 1C60949C        STX     12,GLBRTN MODIFY THE RETURN ADDR
  159                       * TRANSFER THE ARGUMENTS
  160 06AC0  27328 5C220006        LDX     4,NARGX2-2,M
  161 06AC2  27330 16680000 XFER   LDA     0,4,13
  162 06AC4  27332 3E003E00        STA     ARGLST,4
  163 06AC6  27334 6C230002        IMN     4,2,M
  164 06AC8  27336 6096            JU      XFER
  164 06AC9  27337      0700
  165                       *
  166 06ACA  27338 14003E02        LDA     VSCLC
  167 06ACC  27340 0843            SLL     LGWPL
  168 06ACD  27341      0700
  168 06ACE  27342 A4003E00        ADU     HPOS
  169 06AD0  27344 0841            SLL     1         A CONTAINS TVRSTR INDEX OF THE SCALE CENTER
  170 06AD1  27345      06C0       LXA     8
  171 06AD2  27346 06C8            LXA     9
  172 06AD3  27347      0700
  172 06AD4  27348 5C6A0000        LDX     13,0,M
  173                       *
  174                       * COMPUTE (RASTER LINE SPACING)*WPLX2
  175 06AD6  27350 14003E04        LDA     VSPC      VSPC CONTAINS SPACING IN RASTER LINES
  176 06AD8  27352 0844            SLL     LGWPL+1
  177 06AD9  27353      0700
  177 06ADA  27354 3C003E04        STA     VSPC      VSPC NOW CONTAINS SPACING IN TVRSTR WRDS
  178                       *
  179                       * PUT IN THE SCALE CENTER MARK
  180 06ADC  27356 14408000        LDA     TVRSTR,8
  181 06ADE  27358 C4006AB2        LOR     LMARK
  182 06AE0  27360 3C408000        STA     TVRSTR,8
  183                       *
  184                       * NOW PUT IN THE OTHER SCALE MARKS
  185 06AE2  27362 6C413E04 LOOP   IMN     8,VSPC
  186 06AE4  27364 6C483E04        IMP     9,VSPC
  187 06AE6  27366 14408000        LDA     TVRSTR,8
  188 06AE8  27368 C4006AB4        LOR     SMARK
  189 06AEA  27370 3C408000        STA     TVRSTR,8
  190 06AEC  27372 14488000        LDA     TVRSTR,9
  191 06AEE  27374 C4006AB4        LOR     SMARK
  192 06AF0  27376 3C488000        STA     TVRSTR,9
  193 06AF2  27378 6C413E04        IMN     8,VSPC
  194 06AF4  27380 6C483E04        IMP     9,VSPC
  195 06AF6  27382 14408000        LDA     TVRSTR,8
  196 06AF8  27384 C4006AB2        LOR     LMARK
  197 06AFA  27386 3C408000        STA     TVRSTR,8
  198 06AFC  27388 14488000        LDA     TVRSTR,9
  199 06AFE  27390 C4006AB2        LOR     LMARK
  200 06B00  27392 3C488000        STA     TVRSTR,9
  201 06B02  27394 6C6A0004        IMP     13,4,M
  202 06B04  27396 24693E06        ICL     13,VMRKS  VMRKS = NO. OF SCALE DIVISIONS
  203 06B06  27398 7400949C        RTA     GLBRTN
  204 06B08  27400 60A6            JU      LOOP
  205 06B09  27401      0700
  205                       END

    0 ERRORS
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FOCAP-S V10.03 PAGE   1
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  139                       * HSCALE -- HORIZONTAL SCALE SUBROUTINE
  140                       *
  141 00008      8          NARGX2 SETD    8         THE NO. OF ARGUMENTS (TIMES 2) TO BE XFERED
  142 06B12  27410                 ORG     HSCALE
  143 06B12  27410 0400949C        PTR     GLBRTN
  144 06B14  27412 64306B22        JGU     STRTPT
  145                       * STORAGE FOR XFER OF ARGUMENTS INTO THE ROUTINE
  146 03E00  15872           VPOS   EQU     ARGLST   RASTER LINE NO. OF VERTICAL POSITION OF SCALE
  147 03E02  15874           HSTRT  EQU     ARGLST+2 WDR CLMN NO. OF THE BEGINNING OF THE SCALE
  148 03E04  15876           HMSK   EQU     ARGLST+4 MASK NO. THAT DETERMINES THE NO. OF SCALE DIVISIONS
  149 03E06  15878           HSIZE  EQU     ARGLST+6 WIDTH OF SCALE IN WRD COLUMNS
  150                       *
  151                       * STORAGE FOR LOCAL VARIABLES
  152 03E16  15894           MSK    EQU     TEMP+2   STORAGE FOR THE SELECTED MASK
  153 06B16  27414 00000000 SCLMSK HEX     0
  154 06B18  27416 80000000        HEX     80000000
  155 06B1A  27418 80008000        HEX     80008000
  156 06B1C  27420 80808080        HEX     80808080
  157 06B1E  27422 88888888        HEX     88888888
  158 06B20  27424 AAAAAAAA        HEX     AAAAAAAA
  159                       *
  160 06B22  27426 5C60949C STRTPT LDX     12,GLBRTN PUT ADDR OF JS+2 INTO XR12
  161 06B24  27428 34640000        LAE     0,12,I   OBTAIN STRTING LOC OF THE ARGUMENT LIST
  162 06B26  27430 06E8            LXA     13
  163 06B27  27431      0700
  163 06B28  27432 6C620002        IMP     12,2,M
  164 06B2A  27434 1C60949C        STX     12,GLBRTN MODIFY THE RETURN ADDR
  165                       * TRANSFER THE ARGUMENTS
  166 06B2C  27436 5C220006        LDX     4,NARGX2-2,M
  167 06B2E  27438 16680000 XFER   LDA     0,4,13
  168 06B30  27440 3E003E00        STA     ARGLST,4
  169 06B32  27442 6C230002        IMN     4,2,M
  170 06B34  27444 64306B2E        JU      XFER
  171                       *
  172 06B36  27446 14003E04        LDA     HMSK
  173 06B38  27448 0841            SLL     1
  174 06B39  27449      06E8       LXA     13
  175 06B3A  27450 14686B16        LDA     SCLMSK,13
  176 06B3C  27452 3C003E18        STA     MSK+2
  177 06B3E  27454 14686B14        LDA     SCLMSK-2,13
  178 06B40  27456 3C003F16        STA     MSK
  179 06B42  27458 14003E00        LDA     VPOS
  180 06B44  27460 0843            SLL     LGWPL
  181 06B45  27461      0700
  181 06B46  27462 A4003E02        ADU     HSTRT
  182 06B48  27464 0841            SLL     1
  183 06B49  27465      06C0       LXA     8
  184 06B4A  27466 06C8            LXA     9
  185 06B4B  27467      0700
  185 06B4C  27468 14003E06        LDA     HSIZE
  186 06B4E  27470 0841            SLL     1
  187 06B4F  27471      0700
  187 06B50  27472 E4020002        SBU     2,M
  188 06B52  27474 3C003E14        STA     TEMP
  189 06B54  27476 5C620002        LDX     12,2,M
  190 06B56  27478 5C6A0006 LOOP0  LDX     13,6,M
  191 06B58  27480 5C203E14 LOOP1  LDX     4,TEMP
  192 06B5A  27482 18408002        LDA     TVRSTR+8,4,8
  193 06B5C  27484 C4006B18        LOR     SCLMSK+2
  194 06B5E  27486 3E408002        STA     TVRSTR+2,4,8
  195 06B60  27488 16488002        LDA     TVRSTR+2,4,9
  196 06B62  27490 C4006B18        LOR     SCLMSK+2
  197 06B64  27492 3E488002        STA     TVRSTR+2,4,9
  198 06B66  27494 16408000 LOOP2  LDA     TVRSTR,4,8
  199 06B68  27496 C4603E16        LOR     MSK,12
  200 06B6A  27498 3E408000        STA     TVRSTR,4,8
  201 06B6C  27500 16488000        LDA     TVRSTR,4,9
  202 06B6E  27502 C4603E18        LOR     MSK,12
  203 06B70  27504 3E488000        STA     TVRSTR,4,9
  204 06B72  27506 6C230002        IMN     4,2,M
  205 06B74  27508 64306B66        JU      LOOP2
  206 06B76  27510 6C430010        IMN     8,WPLX2,M
  207 06B78  27512 6C4A0010        IMP     9,WPLX2,M
  208 06B7A  27514 6C6B0002        IMN     13,2,M
  209 06B7C  27516 64306B58        JU      LOOP1
  210 06B7E  27518 6C630002        IMN     12,2,M
  211 06B80  27520 64306B56        JU      LOOP0                              0 ERRORS
  212 06B82  27522 7400949C        RTA     GLBRTN
  213                              END
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FOCAP-S V10.03 PAGE   1
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  139                       * VBAR -- VERTICAL BAR SUBROUTINE
  140                       *
  141 0000E     14          NARGX2 SETD    14       THE NO. OF ARGUMENTS (TIMES 2) TO BE XFERED
  142 06B8A   27530                ORG     VBAR
  143 06B8A   27530 0400949C       PTR     GLBRTN
  144 06B8C   27532 64306B98       JGU     STRTPT
  145                       *
  146                       * STORAGE FOR ARGUMENTS XFERED INTO THIS ROUTINE
  147 03E00   15872          VBAR   EQU     ARGLST
  148 03E02   15874          KABAR  EQU     ARGLST+2
  149 03E04   15876          KBBAR  EQU     ARGLST+4
  150 03E06   15878          HPVB   EQU     ARGLST+6
  151 03E08   15880          BARSL  EQU     ARGLST+8
  152 03E0A   15882          VBUL   EQU     ARGLST+10
  153 03E0C   15884          VBLL   EQU     ARGLST+12
  154                       *
  155                       * STORAGE FOR LOCAL VARIABLES AND PARAMETERS
  156 03E0E   15886          BARMSK EQU     ARGLST+14
  157 06B8E   27534 000000E0 BRCODE HEX     000000E0
  158 06B90   27536 00000E00       HEX     00000E00
  159 06B92   27538 00038000       HEX     00038000
  160 06B94   27540 00E00000       HEX     00E00000
  161 06B96   27542 0E000000       HEX     0E000000
  162                       *
  163 06B98   27544 5C60949C STRTPT LDX     12,GLBRTN PUT ADDR OF JS+2 INTO XR12
  164 06B9A   27546 34640000       LAE     0,12,I   OBTAIN STRTING LOC OF THE ARGUMENT LIST
  165 06B9C   27548 06E8           LXA     13
  166 06B9D   27549      0700
  166 06B9E   27550 6C620002       IMP     12,2,M
  167 06BA0   27552 1C60949C       STX     12,GLBRTN MODIFY THE RETURN ADDR
  168                       * TRANSFER THE ARGUMENTS
  169 06BA2   27554 5C22000C       LDX     4,NARGX2-2,M
  170 06BA4   27556 16580000 XFER  LDA     0,4,13
  171 06BA6   27558 3E003E00       STA     APGLST,4
  172 06BA8   27560 6C230002       IMN     4,2,M
  173 06BAA   27562 6086           JU      XFER
  173 06BAB   27563      0700
  174                       * COMPUTE THE BAR CODE WHICH WAS SELECTED AND STORE IT IN BARMSK
  175 06BAC   27564 14003E08       LDA     BARSL
  176 06BAE   27566 0841           SLL     1
  177 06BAF   27567      06C0      LXA     8
  178 06BB0   27568 14406B8E       LDA     BRCODE,8
  179 06BB2   27570 3C003E0E       STA     BARMSK
  180                       * COMPUTE THE STARTING RASTER WORD NO. FROM WHICH THE BAR WILL ORIGINATE
  181 06BB4   27572 14003E04       LDA     KBBAR
  182 06BB6   27574 0400           CFX
  183 06BB7   27575      0500      EAB
  184 06BB8   27576 6204           JG      RND
  185 06BB9   27577      0700
  185 06BBA   27578 AC009404       ADL     IONE
  186 06BBC   27580 0500     RND   EAB
  187 06BBD   27581      0843      SLL     LGWPL
  188 06BBE   27582 A4003E06       ADU     HPVB
  189 06BC0   27584 0841           SLL     1
  190 06BC1   27585      06C0      LXA     8
  191                       * CHECK FOR YBAR WITHIN RANGE, RESCALE IT, AND MODIFY THE INC XR INST WITHIN
  192                       *  THE LOOP
  193 06BC2   27586 14003E00       LDA     YBAR
  194 06BC4   27588 6224           JG      POS
  195 06BC5   27589      0700
  195 06BC6   27590 FC003E0C NEG   SBF     VBLL
  196 06BC8   27592 6306           JL      LOCLL
  197 06BC9   27593      0700
  197 06BCA   27594 14003E00       LDA     YBAR
  198 06BCC   27596 6004           JU      LOCLL+2
  199 06BCD   27597      0700
  199 06BCE   27598 14003E0C LOCLL LDA     VBLL
  200 06BD0   27600 94003E02       MLF     KABAR
  201 06BD2   27602 0400           CFX
  202 06BD3   27603      0500      EAB
  203 06BD4   27604 6204           JG      RNDN
  204 06BD5   27605      0700
  204 06BD6   27606 AC020001       ADL     1,M
  205 06BD8   27608 0500     RNDN  EAB
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FOCAP-S V10.03 PAGE   2
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT


206 06BD9  27609      06E8        LXA     13
207                               *
208                               * ROUTINE TO INSERT THE VERTICAL BAR INTO THE MATRIX
209 06BDA  27610 14408000 BARNEG  LDA     TVRSTR,8
210 06BDC  27612 C4003E0E         LOR     BARMSK
211 06BDE  27614 3C408000         STA     TVRSTR,8
212 06BE0  27616 6C420010         IMN     8,WPLX2,M
213 06BE2  27618 6C6B0001         IMN     13,1,M
214 06BE4  27620 608A             JU      BARNEG
214 06BE5  27621      0700
215 06BE6  27622 74009490         RTA     GLBRTN
216                               *
217 06BE8  27624 FC003E0A POS     SBF     VBUL
218 06BEA  27626 6206             JG      LOCUL
219 06BEB  27627      0700
219 06BEC  27628 14003E00         LDA     VBAR
220 06BEE  27630 6004             JU      LOCUL+2
221 06BEF  27631      0700
221 06BF0  27632 14003E0A LOCUL   LDA     VBUL
222 06BF2  27634 94009480         MLF     MONE
223 06BF4  27636 94003E02         MLF     KABAR
224 06BF6  27638 0400             CFX
225 06BF7  27639      0500        EAB
226 06BF8  27640 6204             JG      RNDP
227 06BF9  27641      0700
227 06BFA  27642 AC020001         ADL     1,M
228 06BFC  27644 0500     RNDP    EAB
229 06BFD  27645      06E8        LXA     13        XR13 CONTAINS THE INTEGER MAGNITUDE OF THE BAR
230                               *
231                               * ROUTINE TO INSERT THE VERTICAL BAR INTO THE MATRIX
232 06BFE  27646 14408000 BARPOS  LDA     TVRSTR,8
233 06C00  27648 C4003E0E         LOR     BARMSK
234 06C02  27650 3C408000         STA     TVRSTR,8
235 06C04  27652 6C430010         IMN     8,WPLX2,M
236 06C06  27654 6C6B0001         IMN     13,1,M
237 06C08  27656 608A             JU      BARPOS
237 06C09  27657      0700
238 06C0A  27658 74009490         RTA     GLBRTN
239                               END

  0 ERRORS
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FOCAP-S V10.03 PAGE   1
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  139                       * VDOF -- VERTICAL DEGREE OF FREEDOM (DOF) SYMBOL SUBROUTINE
  140                       *
  141 0000E     14          NARGX2 SETD    14       THE NO. OF ARGUMENTS (TIMES 2) TO BE XFERED
  142 06C16  27670                 ORG     VDOF
  143 06C16  27670 04009490        PTR     GLBRTN
  144 06C18  27672 64306C84        JGU     STRTPT
  145                       * STORAGE FOR XFER OF ARGUMENTS INTO THE ROUTINE
  146 03E00  15872          VDOF   EQU     ARGLST   SYMBOL  INPUT (FL. PT. MAX ABS VALUE = 1.0)
  147 03E02  15874          KAVD   EQU     ARGLST+2 SCALING PARAMETER
  148 03E04  15876          KBVD   EQU     ARGLST+4 SCALING PARAMETER
  149 03E06  15878          HPVD   EQU     ARGLST+6 URD COLUMN POS OF THE POINTER
  150 03E08  15880          VDSEL  EQU     ARGLST+8 SYMBOL  SELECT
  151 03E0A  15882          VDUL   EQU     ARGLST+10 UPPER LIMIT
  152 03E0C  15884          VDLL   EQU     ARGLST+12 LOWER LIMIT
  153                       * VERTICAL DEGREE OF FREEDOM SYMBOL STORAGE
  154 06C1A  27674 00000002 VDSYM0 HEX     2        LEFT POINTER (<)
  163 06C28  27688 80000000 VDSYM1 HEX     80000000 RIGHT POINTER (>)
  172 06C36  27702 FFFF0000 VDSYM2 HEX     FFFF0000 REF MARK - LEFT SIDE OF SCALE
  173 06C38  27704 0000FFFF VDSYM3 HEX     0000FFFF REF MARK -RIGHT SIDE OF SCALE
  174 06C3A  27706 73C8B9CF VDSYM4 HEX     73C8B9CF CRUISE ALPHA CHAR DOT ARRAY
  183 06C48  27720 7DE11138 VDSYM5 HEX     7DE11138 TRANSITION CHAR DOT ARRAY
  192 06C56  27734 44E45F78 VDSYM6 HEX     44E45F78 HOVER CHAR DOT ARRAY
  201 06C64  27748 F1CF045E VDSYM7 HEX     F1CF045E BOB-UP CHAR DOT ARRAY
  210 06C72  27762          SYMEND EQU     *        END OF SYMBOL STORAGE
  211                       *
  212 06C72  27762 0400601A SYMPTR PTR     VDSYM0
  213 06C74  27764 04006C28        PTR     VDSYM1
  214 06C76  27766 04006C36        PTR     VDSYM2
  215 06C78  27768 04006C38        PTR     VDSYM3
  216 06C7A  27770 04006C3A        PTR     VDSYM4
  217 06C7C  27772 04006C48        PTR     VDSYM5
  218 06C7E  27774 04006C56        PTR     VDSYM6
  219 06C80  27776 04006C64        PTR     VDSYM7
  220 06C82  27778 04006C72        PTR     SYMEND
  221                       *
  222 06C84  27780 5C60949C STRTPT LDX     12,GLBRTN PUT ADDR OF JS+2 INTO XR12
  223 06C86  27782 34640000        LAE     0,12,I   OBTAIN STRTING LOC OF THE ARGUMENT LIST
  224 06C88  27784 06E8            LXA     13
  225 06C89  27785      0700
  225 06C8A  27786 6C620002        IMP     12,2,M
  226 06C8C  27788 1C60949C        STX     12,GLBRTN MODIFY THE RETURN ADDR
  227                       * TRANSFER THE ARGUMENTS
  228 06C8E  27790 5C22000C        LDX     4,NARGX2-2,M
  229 06C90  27792 16680000 XFER   LDA     0,4,13
  230 06C92  27794 3E003E00        STA     ARGLST,4
  231 06C94  27796 6C230002        IMN     4,2,M
  232 06C96  27798 6086            JU      XFER
  232 06C97  27799      0700
  233                       * ARGUMENTS ARE XFERED , NOW SELECT THE PROPER SYMBOL
  234 06C98  27800 14003E08        LDA     VDSEL
  235 06C9A  27802 0841            SLL     1
  236 06C9B  27803      06C0       LXA     8
  237 06C9C  27804 34446C72        LAE     SYMPTR,8,I
  238 06C9E  27806 06E8            LXA     13
  239 06C9F  27807      0700
  239 06CA0  27808 3C003E14        STA     TEMP
  240 06CA2  27810 34446C74        LAE     SYMPTR+2,8,I
  241 06CA4  27812 06A0            LXA     4
  242 06CA5  27813      0700
  243 06CA6  27814 6C213E14        IMN     4,TEMP
  244 06CA8  27816 6C230002        IMN     4,2,M
  245 06CAA  27818 E4003E14        SBU     TEMP     A REG CONT FULL URD LNGTH OF SELECTED SYMB STORAGE
  246 06CAC  27820 0C42            SBA     2                                                  AREA
  247 06CAD  27821      0E44       SLL     LGUPL+1
  248 06CAE  27822 3C003E14        STA     TEMP     TEMP CONTAINS BIAS FOR XRB
  249                       * CHECK FOR VDOF WITHIN RANGE (VDUL < VDOF < VDLL)
  250 06CB0  27824 14003E08        LDA     VDOF
  251 06CB2  27826 E4003E0A        SBF     VDUL
  252 06CB4  27828 6C40            JG      LOOPL
  252 06CB5  27829      0700
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FOCAP-S V10.03 PAGE   2
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

252 06CB6  27830 14003E00        LDA     YDOF     YDOF IS NOT GREATER THAN UPPER LIMIT
253 06CB8  27832 FC003E0C        SBF     VDLL
254 06CBA  27834 630A            JL      LOCLL
255 06CBB  27835     0700
255 06CBC  27836 14003E00        LDA     YDOF     YDOF IS WITHIN RANGE
256 06CBE  27838 6008            JU      LOC0
257 06CBF  27839     0700
257 06CC0  27840 14003E0A LOCUL  LDA     VDUL
258 06CC2  27842 6004            JU      LOC0
259 06CC3  27843     0700
259 06CC4  27844 14003E0C LOCLL  LDA     VDLL
260 06CC6  27846 94003E02 LOC0   MLF     KAVD
261 06CC8  27848 BC003E04        ADF     KBVD
262 06CCA  27850 0400            CFX
263 06CCB  27851     0500        EAB
264 06CCC  27852 6204            JG      RNDP
265 06CCD  27853     0700
265 06CCE  27854 AC009404        ADL     IONE
266 06CD0  27856 0500     RNDP   EAB
267 06CD1  27857     0843        SLL     LQWPL
268 06CD2  27858 A4003E06        ADU     HPVD
269 06CD4  27860 0841            SLL     1
270 06CD5  27861     06C0        LXA     8
271 06CD6  27862 6C413E14        IMN     8,TEMP
272 06CD8  27864 14408000 PTR    LDA     TVRSTR,8
273 06CDA  27866 C4680000        LOR     0,13
274 06CDC  27868 30408000        STA     TVRSTR,8
275 06CDE  27870 6C420010        IMP     8,WPLX2,M
276 06CE0  27872 6C6A0002        IMP     13,2,M
277 06CE2  27874 6C230002        IMN     4,2,M
278 06CE4  27876 608C            JU      PTR
278 06CE5  27877     0700

279 06CE6  27878 74009490 RTN    RTA     GLBRTN
280                              END


  0 ERRORS
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FOCAP-8 V10.03 PAGE   1
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  139                       * XYDOF -- FIXED SIZE SYMBOL ROUTINE WITH TWO (X AND Y) TRANSLATIONAL DEGREES
  140                       *          OF FREEDOM (DOF)
  141                       *
  142 0000E     14          NARGX8 SETD    14       THE NO. OF ARGUMENTS (TIMES 8) TO BE XFERED
  143 06CF2  27890          ORG    XYDOF
  144 06CF2  27890 0400949C PTR    GLBRTN
  145 06CF4  27892 64306EF8 JGU    STRTPT
  146 06CF6  27894 42C00000 SIXTEEN DEC    16.0
  147                       * STORAGE FOR XFER OF ARGUMENTS INTO THE ROUTINE
  148 03E00  15872          XFX    EQU    ARGLST    FIXED SIZE SYMBOL X INPUT
  149 03E02  15874          YFX    EQU    ARGLST+2  FIXED SIZE SYMBOL Y INPUT
  150 03E04  15876          KAFX   EQU    ARGLST+4  SCALING PARAMETER
  151 03E06  15878          KBFX   EQU    ARGLST+6  SCALING PARAMETER
  152 03E08  15880          KCFX   EQU    ARGLST+8  SCALING PARAMETER
  153 03E0A  15882          KDFX   EQU    ARGLST+10 SCALING PARAMETER
  154 03E0C  15884          XY     EQU    ARGLST+12 FIXED SIZE SYMBOL SELECTED
  155                       * STORAGE FOR THE FIXED SYMBOLS
  156 06CF8  27896 00000078 FXSYM0 HEX    00000078  MALE SYMBOL
  178 06D20  27936 0003E000 FXSYM1 HEX    0003E000  FEMALE SYMBOL
  203 06D4E  27982 0001C000 FXSYM2 HEX    1C000     LARGE CROSS
  228 06D7C  28028 00008000 FXSYM3 HEX    00008000  SMALL CROSS
  253 06DAA  28074 0007F000 FXSYM4 HEX    0007F000 LARGE CIRCLE
  286 06DE8  28136 0003E000 FXSYM5 HEX    0003E000  SMALL CIRCLE
  303 06E06  28166 0001C000 FXSYM6 HEX    0001C000 SOLID SMALL CIRCLE
  312 06E14  28180 0007F000 FXSYM7 HEX    0007F000 DOWN POINTER
  322 06E22  28194 00008000 FXSYM8 HEX    00008000 UP POINTER
  332 06E30  28208 00008000 FXSYM9 HEX    00008000 UP OR DOWN POINTER
  347 06E4A  28234 00041000 FXSM10 HEX    00041000 LARGE SEMI CIRCLE
  380 06E98  28296 03FFFFE0 FXSM11 HEX    03FFFFE0 BOX
  403 06EB2  28338 7FF087FF FXSM12 HEX    7FF087FF ATTITUDE REF MARK
  410 06EBC  28348          SYMEND EQU    *
  411                       *
  412 06EBC  28348 04006CF8 SYMPTR PTR    FXSYM0
  413 06EBE  28350 04006D20        PTR    FXSYM1
  414 06EC0  28352 04006D4E        PTR    FXSYM2
  415 06EC2  28354 04006D7C        PTR    FXSYM3
  416 06EC4  28356 04006DAA        PTR    FXSYM4
  417 06EC6  28358 04006DE8        PTR    FXSYM5
  418 06EC8  28360 04006E06        PTR    FXSYM6
  419 06ECA  28362 04006E14        PTR    FXSYM7
  420 06ECC  28364 04006E22        PTR    FXSYM8
  421 06ECE  28366 04006E30        PTR    FXSYM9
  422 06ED0  28368 04006E4A        PTR    FXSM10
  423 06ED2  28370 04006E98        PTR    FXSM11
  424 06ED4  28372 04006EB2        PTR    FXSM12
  425 06ED6  28374 04006EBC        PTR    SYMEND
  426                       *
  427 06ED8  28376 04006D10 SYMCTR PTR    CTR0
  428 06EDA  28378 04006D2E        PTR    CTR1
  429 06EDC  28380 04006D64        PTR    CTR2
  430 06EDE  28382 04006D92        PTR    CTR3
  431 06EE0  28384 04006DC8        PTR    CTR4
  432 06EE2  28386 04006DF6        PTR    CTR5
  433 06EE4  28388 04006E0C        PTR    CTR6
  434 06EE6  28390 04006E14        PTR    CTR7
  435 06EE8  28392 04006E2E        PTR    CTR8
  436 06EEA  28394 04006E3C        PTR    CTR9
  437 06EEC  28396 04006E68        PTR    CTR10
  438 06EEE  28398 04006E9C        PTR    CTR11
  439 06EF0  28400 04006EB2        PTR    FXSM12
  440                       *
  441 06EF2  28402 5C60949C STRTPT LDX    12,GLBRTN PUT ADDR OF JS+2 INTO XR12
  442 06EF4  28404 34640000        LAE    0,12,I   OBTAIN STRTING LOC OF THE ARGUMENT LIST
  443 06EF6  28406 06E8            LXA    13
  444 06EF7  28407     0700
  444 06EF8  28408 6C620002        IMP    12,2,M
  445 06EFA  28410 1C60949C        STX    12,GLBRTN MODIFY THE RETURN ADDR
  446                       * TRANSFER THE ARGUMENTS
  447 06EFC  28412 5C22000C        LDX    4,NARGX2-2,M
  448 06EFE  28414 16680000 XFER   LDA    0,4,13
  449 06F00  28416 3E003E00        STA    ARGLST,4
  450 06F02  28418 6C230002        IMN    4,2,M
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

451 06F04  28420 6086            JU      XFER
451 06F05  28421      0700
452                         *
453                         * ARGUMENTS ARE XFERED , NOW SELECT THE PROPER SYMBOL
454 06F06  28422 14003E0C        LDA     XY
455 06F08  28424 0841            SLL     1
456 06F09  28425      06C0       LXA     8
457 06F0A  28426 34446EBC        LAE     SYMPTR,8,I
458 06F0C  28428 06E8            LXA     13
459 06F0D  28429      0700
459 06F0E  28430 3C003E14        STA     TEMP
460 06F10  28432 34446EBE        LAE     SYMPTR+2,8,I
461 06F12  28434 06E0            LXA     12
462 06F13  28435      0700
462 06F14  28436 6C613E14        IMN     12,TEMP
463 06F16  28438 6C630002        IMN     12,2,M
464 06F18  28440 34446ED8        LAE     SYMCTR,8,I
465 06F1A  28442 E4003E14        SBU     TEMP
466 06F1C  28444 0843            SLL     LGWPL
467 06F1D  28445      0700
467 06F1E  28446 3C003E14        STA     TEMP      TEMP CONTAINS BIAS FOR XR8
468                         *
469 06F20  28448 14003E02        LDA     YFX        CHECK FOR (-1.0 < Y1 < 1.0)
470 06F22  28450 FC00948A        SBF     ONE
471 06F24  28452 620C            JG      ULIM1      (Y1 - 1.0) > 0
472 06F25  28453      0700
472 06F26  28454 14003E02        LDA     YFX
473 06F28  28456 FC00948C        SBF     MONE
474 06F2A  28458 630A            JL      LLIM1      (Y1 + 1.0) < 0
475 06F2B  28459      0700
475 06F2C  28460 14003E02        LDA     YFX
476 06F2E  28462 6008            JU      LOC0
477 06F2F  28463      0700
477 06F30  28464 1400948A ULIM1  LDA     ONE       YFX IS SET TO THE UPPER LIMIT +1.0
478 06F32  28466 6004            JU      LOC0
479 06F33  28467      0700
479 06F34  28468 1400948C LLIM1  LDA     MONE      YFX IS SET TO THE LOWER LIMIT -1.0
480 06F36  28470 94003E04 LOC0   MLF     KAFX
481 06F38  28472 BC003E06        ADF     KBFX
482 06F3A  28474 0400            CFX
483 06F3B  28475      0801       SLLD    1
484 06F3C  28476 8C020001        SAM     1,M
485 06F3E  28478 6004            JU      *+4
485 06F3F  28479      0700
486 06F40  28480 A4020001        ADU     1,M
487 06F42  28482 0C41            SRA     1
488 06F43  28483      0844       SLL     4
489 06F44  28484 06C0            LXA     8
490 06F45  28485      0700
490 06F46  28486 6C413E14        IMN     8,TEMP
491                         *
492 06F48  28488 14003E00        LDA     XFX        CHECK FOR (-1.0 < X1 < 1.0)
493 06F4A  28490 FC00948A        SBF     ONE
494 06F4C  28492 620C            JG      ULIM2      (X1 - 1.0) > 0
495 06F4D  28493      0700
495 06F4E  28494 14003E00        LDA     XFX
496 06F50  28496 FC00948C        SBF     MONE
497 06F52  28498 630A            JL      LLIM2      (X1 + 1.0) < 0
498 06F53  28499      0700
498 06F54  28500 14003E00        LDA     XFX
499 06F56  28502 6008            JU      LOC1
500 06F57  28503      0700
500 06F58  28504 1400948A ULIM2  LDA     ONE       XFX IS SET TO THE UPPER LIMIT 1.0
501 06F5A  28506 6004            JU      LOC1
502 06F5B  28507      0700
502 06F5C  28508 1400948C LLIM2  LDA     MONE      XFX IS SET TO THE LOWER LIMIT -1.0
503 06F5E  28510 94003E08 LOC1   MLF     KCFX
504 06F60  28512 BC003E0A        ADF     KDFX
505 06F62  28514 B4006CF6        DVF     SIXTEEN
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FOCAP-S V10.03 PAGE   3
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

506 06F64  28516 0400            CFX
507 06F65  28517     0700
507 06F66  28518 8C020001        SAM     1,M
508 06F68  28520 6026            JU      EVEN
508 06F69  28521     0700
509 06F6A  28522 8402000E        AND     14,M
510 06F6C  28524 3C003E14        STA     TEMP
511 06F6E  28526 6C403E14        IMP     8,TEMP
512 06F70  28528 14020000        LDA     0,M
513 06F72  28530 0804            SLLD    LGBPW-1
514 06F73  28531     06A0        LXA     4
515 06F74  28532 54020000 LOOPO  LDB     0,M
516 06F76  28534 14680000        LDA     0,13
517 06F78  28536 0E20            SRCD    0,4
518 06F79  28537     0700
518 06F7A  28538 C4408000        LOR     TVRSTR,8
519 06F7C  28540 3C408000        STA     TVRSTR,8
520 06F7E  28542 0500            EAB
521 06F7F  28543     0700
521 06F80  28544 C4408002        LOR     TVRSTR+2,8
522 06F82  28546 3C408002        STA     TVRSTR+2,8
523 06F84  28548 6C420010        IMP     8,WPLX2,M
524 06F86  28550 6C6A0002        IMP     13,2,M
525 06F88  28552 6C630002        IMH     12,2,M
526 06F8A  28554 6096            JU      LOOPO
526 06F8B  28555     0700
527 06F8C  28556 74009490        RTA     GLBRTN
528 06F8E  28558 5C220010 EVEN   LDX     4,16,M
529 06F90  28560 0C41            SRA     1
530 06F91  28561     0841        SLL     1
531 06F92  28562 3C003E14        STA     TEMP
532 06F94  28564 6C403E14        IMP     8,TEMP
533 06F96  28566 14020000        LDA     0,M
534 06F98  28568 0804            SLLD    LGBPW-1
535 06F99  28569     0700
535 06F9A  28570 3C003E14        STA     TEMP
536 06F9C  28572 6C213E14        IMH     4,TEMP
537 06F9E  28574 54020000 LOOPE  LDB     0,M
538 06FA0  28576 14680000        LDA     0,13
539 06FA2  28578 0A20            SLCD    0,4
540 06FA3  28579     0700
540 06FA4  28580 C4408000        LOR     TVRSTR,8
541 06FA6  28582 3C408000        STA     TVRSTR,8
542 06FA8  28584 0500            EAB
543 06FA9  28585     0700
543 06FAA  28586 C4407FFE        LOR     TVRSTR-2,8
544 06FAC  28588 3C407FFE        STA     TVRSTR-2,8
545 06FAE  28590 6C420010        IMP     8,WPLX2,M
546 06FB0  28592 6C6A0002        IMP     13,2,M
547 06FB2  28594 6C630002        IMH     12,2,M
548 06FB4  28596 6096            JU      LOOPE
548 06FB5  28597     0700
549 06FB6  28598 74009490        RTA     GLBRTN
550 07214  29204                 ORG     29204
551 07214  29204 00000800        HEX     00000800
552 07216  29206 00000FFF        HEX     00000FFF
553 07218  29208 000007FF        HEX     000007FF
554                               END

  0 ERRORS
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FOCAP-S V10.03 PAGE   1
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  139                       * DRDOUT -- ROUTINE TO GENERATE A DIGITAL READOUT SYMBOL
  140                       *
  141 0000A     10          NARGX2 SETD    10       THE NO. OF ARGUMENTS (TIMES 2) TO BE XFERED
  142 06FC2  28610                 ORG     DRDOUT
  143 06FC2  28610 0400949C        PTR     GLBRTN
  144 06FC4  28612 6430709E        JGU     STRTPT
  145 03E00  15872          INPT   EQU     ARGLST
  146 03E02  15874          NMB0   EQU     ARGLST+2
  147 03E04  15876          STLN   EQU     ARGLST+4
  148 03E06  15878          STWC   EQU     ARGLST+6
  149 03E08  15880          TITLE  EQU     ARGLST+8
  150 06FC6  28614 0000001F DGTMSK HEX     0000001F MASKS FOR THE INDIVIDUAL DIGIT POSITIONS
  151 06FC8  28616 000007C0        HEX     000007C0
  152 06FCA  28618 0001F000        HEX     0001F000
  153 06FCC  28620 007C0000        HEX     007C0000
  154 06FCE  28622 1F000000        HEX     1F000000
  155 06FD0  28624 E0000C00        HEX     E0000000
  156 06FD2  28626 00022F1C TTLS   HEX     00022F1C HDG
  157 06FD4  28628 000224A2        HEX     000224A2 HDG
  158 06FD6  28630 000224A0        HEX     000224A0 HDG
  159 06FD8  28632 0003E4A0        HEX     0003E4A0 HDG
  160 06FDA  28634 000224A6        HEX     000224A6 HDG
  161 06FDC  28636 000224A2        HEX     000224A2 HDG
  162 06FDE  28638 00022F1C        HEX     00022F1C HDG
  163 06FE0  28640          LOCRTN BSS     2
  164 06FE2  28642 0000801C        HEX     0000801C AIRSPEED
  165 06FE4  28644 000140A2        HEX     000140A2 AIRSPEED
  166 06FE6  28646 00022120        HEX     00022120 AIRSPEED
  167 06FE8  28648 0002221C        HEX     0002221C AIRSPEED
  168 06FEA  28650 0003E402        HEX     0003E402 AIRSPEED
  169 06FEC  28652 00022822        HEX     00022822 AIRSPEED
  170 06FEE  28654 0002201C        HEX     0002201C AIRSPEED
  171 06FF0  28656 0000000A TEN    DEC     10
  172 06FF2  28658 0003C89C        HEX     0003C89C RANGE
  173 06FF4  28660 00012CA2        HEX     00012CA2 RANGE
  174 06FF6  28662 00012AA0        HEX     00012AA0 RANGE
  175 06FF8  28664 0001CAA0        HEX     0001CAA0 RANGE
  176 06FFA  28666 000129A6        HEX     000129A6 RANGE
  177 06FFC  28668 000128A2        HEX     000128A2 RANGE
  178 06FFE  28670 0001289C        HEX     0001289C RANGE
  179 07000  28672 0E38E38E NUMBRS HEX     0E38E38E ZERO
  180 07002  28674 11451451        HEX     11451451
  181 07004  28676 11451451        HEX     11451451
  182 07006  28678 11451451        HEX     11451451
  183 07008  28680 11451451        HEX     11451451
  184 0700A  28682 11451451        HEX     11451451
  185 0700C  28684 0E38E38E        HEX     0E38E38E
  186 0700E  28686 0CCCCCCC TENTH  HEX     0CCCCCCC
  187 07010  28688 0E38E38E        HEX     0E38E38E ONE
  188 07012  28690 04104104        HEX     04104104 ONE
  189 07014  28692 04104104        HEX     04104104 ONE
  190 07016  28694 04104104        HEX     04104104 ONE
  191 07018  28696 04104104        HEX     04104104 ONE
  192 0701A  28698 0C30C30C        HEX     0C30C30C ONE
  193 0701C  28700 04104104        HEX     04104104 ONE
  194 0701E  28702 C71C71C0 SGNWRD HEX     C71C71C0 SIGN WORD - CONTAINS MINUS SIGN FOR ALL DIGIT POSITIONS
  195 07020  28704 1F7DF7DF        HEX     1F7DF7DF TWO
  196 07022  28706 08208208        HEX     08208208 TWO
  197 07024  28708 04104104        HEX     04104104 TWO
  198 07026  28710 02082082        HEX     02082082 TWO
  199 07028  28712 01041041        HEX     01041041 TWO
  200 0702A  28714 11451451        HEX     11451451 TWO
  201 0702C  28716 0E38E38E        HEX     0E38E38E TWO
  202 0702E  28718          SIGN   BSS     2
  203 07030  28720 0E38E38E        HEX     0E38E38E THREE
  204 07032  28722 11451451        HEX     11451451 THREE
  205 07034  28724 01041041        HEX     01041041 THREE
  206 07036  28726 06186186        HEX     06186186 THREE
  207 07038  28728 01041041        HEX     01041041 THREE
  208 0703A  28730 11451451        HEX     11451451 THREE
  209 0703C  28732 0E38E38E        HEX     0E38E38E THREE
  210 0703E  28734 00000000        HEX     0
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

211 07040  28736 02082082        HEX     02082082 FOUR
212 07042  28738 02082082        HEX     02082082 FOUR
213 07044  28740 1F7DF7DF        HEX     1F7DF7DF FOUR
214 07046  28742 12492492        HEX     12492492 FOUR
215 07048  28744 0A28A28A        HEX     0A28A28A FOUR
216 0704A  28746 06186186        HEX     06186186 FOUR
217 0704C  28748 02082082        HEX     02082082 FOUR
218 0704E  28750 00000000        HEX     0
219 07050  28752 1E79E79E        HEX     1E79E79E FIVE
220 07052  28754 01041041        HEX     01041041 FIVE
221 07054  28756 01041041        HEX     01041041 FIVE
222 07056  28758 1E79E79E        HEX     1E79E79E FIVE
223 07058  28760 10410410        HEX     10410410 FIVE
224 0705A  28762 10410410        HEX     10410410 FIVE
225 0705C  28764 1F7DF7DF        HEX     1F7DF7DF FIVE
226 0705E  28766 00000000        HEX     0
227 07060  28768 0E38E38E        HEX     0E38E38E SIX
228 07062  28770 11451451        HEX     11451451 SIX
229 07064  28772 19659659        HEX     19659659 SIX
230 07066  28774 16596596        HEX     16596596 SIX
231 07068  28776 10410410        HEX     10410410 SIX
232 0706A  28778 11451451        HEX     11451451 SIX
233 0706C  28780 0E38E38E        HEX     0E38E38E SIX
234 0706E  28782 00000000        HEX     0
235 07070  28784 08208208        HEX     08208208 SEVEN
236 07072  28786 08208208        HEX     08208208 SEVEN
237 07074  28788 04104104        HEX     04104104 SEVEN
238 07076  28790 04104104        HEX     04104104 SEVEN
239 07078  28792 02082082        HEX     02082082 SEVEN
240 0707A  28794 01041041        HEX     01041041 SEVEN
241 0707C  28796 1F3DF3DF        HEX     1F3DF3DF SEVEN
242 0707E  28798 00000000        HEX     0
243 07080  28800 0E38E38E        HEX     0E38E38E EIGHT
244 07082  28802 11451451        HEX     11451451 EIGHT
245 07084  28804 11451451        HEX     11451451 EIGHT
246 07086  28806 0E38E38E        HEX     0E38E38E EIGHT
247 07088  28808 11451451        HEX     11451451 EIGHT
248 0708A  28810 11451451        HEX     11451451 EIGHT
249 0708C  28812 0E38E38E        HEX     0E38E38E EIGHT
250 0708E  28814 00000000        HEX     0
251 07090  28816 0E38E38E        HEX     0E38E38E NINE
252 07092  28818 11451451        HEX     11451451 NINE
253 07094  28820 01041041        HEX     01041041 NINE
254 07096  28822 0F3CF3CF        HEX     0F3CF3CF NINE
255 07098  28824 11451451        HEX     11451451 NINE
256 0709A  28826 11451451        HEX     11451451 NINE
257 0709C  28828 0E38E38E        HEX     0E38E38E NINE
258                        *
259                        *
260 0709E  28830 5C60949C STRTPT LDX     12,GLBRTN PUT ADDR OF JS+2 INTO XR12
261 070A0  28832 34640000        LAE     0,12,I   OBTAIN STRTING LOC OF THE ARGUMENT LIST
262 070A2  28834 06E8            LXA     13
263 070A3  28835     0700
263 070A4  28836 6C620002        IMP     12,2,M
264 070A6  28838 1C60949C        STX     12,GLBRTN MODIFY THE RETURN ADDR
265                        * TRANSFER THE ARGUMENTS
266 070A8  28840 5C220008        LDX     4,NARGX2-2,M
267 070AA  28842 16680000 XFER   LDA     0,4,13
268 070AC  28844 3E003E00        STA     ARGLST,4
269 070AE  28846 6C230002        IMN     4,2,M
270 070B0  28848 6086            JU      XFER
270 070B1  28849     0700
271                        *
272                        *
273                        *
274                        *
275 070B2  28850 14003E04 STRT1  LDA     STLN
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LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

276 070B4  28852 0844           SLL     4
277 070B5  28853     0700
277 070B6  28854 A4003E06       ADU     STWC
278 070B8  28856 06C0           LXA     8
279 070B9  28857     0700
279 070BA  28858 14003E08       LDA     TITLE
280 070BC  28860 0844           SLL     4
281 070BD  28861     06C8       LXA     9
282                     *
283 070BE  28862 14009486       LDA     ONES     PUT THE BORDER ABOVE AND BELOW THE DIGITAL DISPLAY
284 070C0  28864 3C407FD0       STA     TVRSTR-48,8
285 070C2  28866 3C407FCE       STA     TVRSTR-50,8
286 070C4  28868 3C40808E       STA     TVRSTR+142,8
287 070C6  28870 3C408090       STA     TVRSTR+144,8
288 070C8  28872 5C220006       LDX     4,6,M
289 070CA  28874 14407FFE TITL  LDA     TVRSTR-2,8
290 070CC  28876 C4486FD2       LOR     TTLS,9
291 070CE  28878 3C407FFE       STA     TVRSTR-2,8
292 070D0  28880 6C420010       IMP     8,16,M
293 070D2  28882 6C4A0002       IMP     9,2,M
294 070D4  28884 6C230001       IMN     4,1,M
295 070D6  28886 6080           JU      TITL
295 070D7  28887     0700
296 070D8  28888 6C430070       IMN     8,112,M
297 070DA  28890 5C5A0000       LDX     11,0,M
298 070DC  28892 14003E00       LDA     INPT
299 070DE  28894 54020000       LDB     0,M
300 070E0  28896 6206           JG      PINPT
301 070E1  28897     0700
301 070E2  28898 9400948C       MLF     MONE
302 070E4  28900 54020001       LDB     1,M
303 070E6  28902 7C00702E PINPT STB     SIGN
304 070E8  28904 54020000       LDB     0,M
305 070EA  28906 0400           CFX
306 070EB  28907     0801       SLLD    1
307 070EC  28908 8C020001       SAM     1,M      TEST FOR ROUNDOFF
308 070EE  28910 6004           JU      SHBK0
308 070EF  28911     0700
309 070F0  28912 A4020001       ADU     1,M
310 070F2  28914 0861     SHBK0 SRLD    1
311 070F3  28915     0700
311 070F4  28916 D400700E       MUL     TENTH
312 070F6  28918 3C003E00       STA     INPT
313 070F8  28920 0500           EAB
314 070F9  28921     0861       SRLD    1
315 070FA  28922 D402000A       MUL     10,M
316 070FC  28924 0801           SLLD    1
317 070FD  28925     0700
317 070FE  28926 8C020001       SAM     1,M
318 07100  28928 6014           JU      SHBK1
318 07101  28929     0700
319 07102  28930 CC02001F       EXO     31,M
320 07104  28932 8C020012       SAM     18,M
321 07106  28934 6008           JU      ITS9
321 07107  28935     0700
322 07108  28936 CC02001F       EXO     31,M
323 0710A  28938 A4020001       ADU     1,M
324 0710C  28940 6008           JU      SHBK1
325 0710D  28941     0700
325 0710E  28942 14020001 ITS9  LDA     1,M
326 07110  28944 5C3A0000       LDX     7,0,M
327 07112  28946 A7803E00       ADUR    INPT
328 07114  28948 0861     SHBK1 SRLD    1
329 07115  28949     0844       SLL     4
330 07116  28950 06C8           LXA     9
```

```
FOCAP-S V10.03 PAGE   4
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  331 07117  28951     0700
  331 07118  28952 5C22000C         LDX     4,12,M
  332 0711A  28954 16487000 WRTDGT LDA     NUMBRS,4,9
  333 0711C  28956 84586FC6         AND     DGTMSK,11
  334 0711E  28958 C4408000         LOR     TVRSTR,8
  335 07120  28960 3C408000         STA     TVRSTR,8
  336 07122  28962 6C420010         IMP     8,16,M
  337 07124  28964 60230002         IMN     4,2,M
  338 07126  28966 608C             JU      WRTDGT
  338 07127  28967     0700
  339 07128  28968 14003E00         LDA     INPT
  340 0712A  28970 6C430070         IMN     8,112,M
  341 07120  28978 6C5A0002         IMP     11,8,M
  342 0718E  28974 84593E08         ICL     11,NMB0
  343 07130  28976 6004             JU      TSTA
  343 07131  28977     0700
  344 07132  28978 60BE             JU      SHBK0+2
  345 07133  28979     0700
  345 07134  28980 8C009486 TSTA    SAM     ONES
  346 07136  28982 6008             JU      TSTSGN
  348 07137  28983     0700
  342 07138  28984 245B000A         ICL     11,10,M
  348 0713A  28986 6004             JU      TSTSGN
  348 0713B  28987     0700
  349 0713C  28988 60C8             JU      SHBK0+2
  350 0713D  28989     0700
  350 0713E  28990 1400702E TSTSGN LDA     SIGN
  351 07140  28992 8C020001         SAM     1,M
  352 07142  28994 7400949C         RTA     GLBRTN
  353 07144  28996 1400701E         LDA     SGNWRD
  354 07146  28998 84586FC6         AND     DGTMSK,11
  355 07148  29000 C4408040         LOR     TVRSTR+64,8
  356 0714A  29002 3C408040         STA     TVRSTR+64,8
  357 0714C  29004 7400949C         RTA     GLBRTN
  358                               END

    0 ERRORS
```

APPENDIX B

VARIAN PRINTER/PLOTTER ROUTINE (PRNTSM)

This appendix contains the SKC-2000 computer listing for the PRNTSM routine. This routine was used to output in the report onto a Varian electrostatic printer/plotter.

```
FOCAP-S V10.03 PAGE   1
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  139                       * PRNTSM -- SUBROUTINE TO OUTPUT THE SYMBOL MATRIX TO THE STATOS PRINTER/PLOTTER
  140                       *             XR8 MUST CONTAIN THE STARTING ADDRESS OF THE BUFFER TO BE OUTPUT.
  141                       *
  142 04100  16640                     ORG     PRNTSM'
  143 04100  16640 0400949C           PTR     GLBRTN
  144 04102  16642 6430416E            JGU     MTRXOUT
  145 04104  16644 C5809444 LORINS     LOR     BMSK1,3
  146 04106  16646 0700     NOPINS     NOP
  147 04107  16647     0700           NOP
  148                       *
  149 04108  16648 00000003 MAG        HEX      3  MAGNIFICATION  (1< MAG <5 )
  150 0410A  16650 00000000 LGHDIV     DEC      0        BASE 2 LOG OF THE NO. OF DESIRED HORIZONTAL GRID LINES
  151 0410C  16652 00000000 LGVDIV     DEC      0        BASE 2 LOG OF THE NO. OF DESIRED VERTICAL GRID LINES
  152 0410E  16654          HSPACE     BSS      2
  153 04110  16656          VSPACE     BSS      2
  154 04112  16658          WPLXMG     BSS      2  -2*WPL*MAG
  155 04114  16660          SARSTR     BSS      2
  156 04116  16662          SCNBUF     BSS      88 SCAN LINE BUFFER STORAGE
  157                       *COMPUTE THE NO. OF HALF WORDS ON A MAGNIFIED LINE
  158 0416E  16750 14004108 MTRXOUT    LDA      MAG
  159 04170  16752 9844               SLL      LGWPL+1
  160 04171  16753     0700
  160 04172  16754 3C004112           STA      WPLXMG
  161                       * COMPUTE THE NO. OF RASTER LINES BETWEEN SCALE DIVISIONS
  162 04174  16756 14020100           LDA      RL,M
  163 04176  16758 5C18410C           LDX      3,LGVDIV
  164 04178  16760 0DC0               SRA      0,3
  165 04179  16761     0700
  165 0417A  16762 3C004110           STA      VSPACE
  166                       * COMPUTE THE NO. OF RASTER COLUMNS BETWEEN SCALE DIVISIONS
  167 0417C  16764 14004112           LDA      WPLXMG
  168 0417E  16766 5C18410A           LDX      3,LGHDIV
  169 04180  16768 0DC0               SRA      0,3
  170 04181  16769     0700
  170 04182  16770 3C00410E           STA      HSPACE
  171                       * COMPUTE THE STARTING ADDRESS OF THE ARRAY TO BE OUTPUT.
  172 04184  16772 1C404114           STX      8,SARSTR
  173 04186  16774 140141AE           LDAH     NXWRD+2
  174 04188  16776 C4004114           LOR      SARSTR
  175 0418A  16778 3C0041AE           STA      NXWRD+2
  176                       *READY THE STATOS
  177 0418C  16780 64044234            JS       LPEBL  ENABLE THE STATOS
  178 0418E  16782 6404424C            JS     RSTRMD  PUT THE STATOS IN RASTER MODE
  179 04190  16784 6404425A            JS     TOF     TOP OF FORM
  180 04192  16786 64044268            JS     SYNC    RESET THE STATOS SCAN PTR
  181                       *
  182                       *OUTPUT A TOP BORDER
  183 04194  16788 64044284            JS       CLRSCN  CLR THE SCNBUF
  184 04196  16790 64044296            JS       FILBUF  FILL THE NO. OF WRDS REQD FOR THE TOP BORDER
  185 04198  16792 640442BC            JS       PRNTLN  PRINT THE LINE
  186                       *
```

```
FOCAP-S V10.03 PAGE   2
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

  187                       *ROUTINE TO LOAD SCNBUF WITH ONE LINE, PROPERLY
  188                       *  MAGNIFIED, FROM THE SYMBOL MATRIX
  189 0419A  16794 5C420000        LDX     8,0,M
  190 0419C  16796 5C6A0000         LDX     13,0,M
  191 0419E  16798 64044284 NXLINE  JS     CLRSCN  CLEAR THE SCAN BUFFER
  192 041A0  16800 640442A8         JS      VGRID
  193 041A2  16802 14020000         LDA   0,M
  194 041A4  16804 06E0             LXA     12 XR12-SCNBUF WRD CTR
  195 041A5  16805     06D0         LXA     10 XR10-WRD WITHIN LINE CTR (SYMBOL MATRIX)
  196 041A6  16806 0698             LXA     3  XR3-SCNBUF WRD BIT CTR
  197 041A7  16807     0700
  197 041A8  16808 14009444         LDA     BMSK1
  198 041AA  16810 3C604116         STA     SCNBUF,12  INSERT A LEFT SIDE BORDER
  199 041AC  16812 5C4A0000 NXWRD   LDX     9,0,M XR9-BIT CTR
  200 041AE  16814 54400000        LDB     0,8
  201 041B0  16816 7C003E14         STB     TEMP
  202 041B2  16818 5C120000 NXBIT   LDX     2,0,M XR2-MAGNIFICATION INDEX
  203 041B4  16820 54003E14         LDB     TEMP
  204 041B6  16822 0801             SLLD    1
  205 041B7  16823     0700
  205 041B8  16824 7C003E14         STB     TEMP
  206 041BA  16826 8C009404         SAM     IONE
  207 041BC  16828 6004             JU      BLANK
  207 041BD  16829     0700
  208 041BE  16830 6008             JU      DOT
  209                       *
  210 041BF  16831     0700
  210 041C0  16832 14004106 BLANK   LDA     NOPINS
  211 041C2  16834 3C0041CE         STA     NSRTBT+2
  212 041C4  16836 6008             JU      NSRTBT
  213 041C5  16837     0700
  213 041C6  16838 14004104 DOT     LDA     LORINS
  214 041C8  16840 3C0041CE         STA     NSRTBT+2
  215 041CA  16842 6002             JU      NSRTBT
  216                       *
  217                       *ROUTINE TO INSERT A ONE OR ZERO INTO THE SCNBUF WORD
  218 041CB  16843     0700
  218 041CC  16844 14604116 NSRTBT  LDA     SCNBUF,12
  219 041CE  16846 C5809444         LOR     BMSK1,3
  220 041D0  16848 3C604116         STA     SCNBUF,12
  221 041D2  16850 6C1A0002         IMP     3,2,M
  222 041D4  16852 241B0040         ICL     3,BPWX2,M  END OF WRD IN SCNBUF?
  223 041D6  16854 600A             JU      TST1       YES
  223 041D7  16855     0700
  224 041D8  16856 6C120001 NSRTB1  IMP     2,1,M      NO
  225 041DA  16858 24114108         ICL     2,MAG      MAGNIF OF BIT COMPLETE?
  226 041DC  16860 600A             JU      TST2       YES
  226 041DD  16861     0700
  227 041DE  16862 6092             JU     NSRTBT  NO
  228                       *
  229                       *THE END OF A WRD WITHIN THE SCNBUF WAS REACHED
  230 041DF  16863     0700
  230 041E0  16864 5C1A0000 TST1    LDX     3,0,M  RESET SCNBUF BIT PTR
  231 041E2  16866 6C620002         IMP     12,2,M INC SCNBUF WRD CTR
  232 041E4  16868 608C             JU      NSRTB1
  233                       *
  234                       *THE SYMBOL MATRIX BIT HAS BEEN PROPERLY MAGNIFIED
  235 041E5  16869     0700
  235 041E6  16870 6C4A0001 TST2    IMP     9,1,M
  236 041E8  16872 244B0020         ICL     9,BPW,M  END OF SYMBOL MATRIX WRD?
  237 041EA  16874 6004             JU      TST3     YES
  237 041EB  16875     0700
  238 041EC  16876 60BA             JU      NXBIT    NO
  239                       *
  240                       *
  241                       *THE END OF A SYMBOL MATRIX WRD WAS REACHED
  242 041ED  16877     0700
  242 041EE  16878 6C420002 TST3    IMP     8,2,M  INC TVRSTR WRD CTR
  243 041F0  16880 6C520001         IMP     10,1,M  INC WRD WITHIN LINE CTR
  244 041F2  16882 24530008         ICL     10,WPL,M  END OF SYMBOL MATRIX LINE
  245 041F4  16884 6004             JU      RTBRDR  YES
  245 041F5  16885     0700
  246 041F6  16886 60CA             JU      NXWRD     NO
```

```
FOCAP-S V10.03 PAGE   3
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

                                *
                                *THE END OF THE SYMBOL MATRIX LINE WAS REACHED, NOW
                                * INSERT A RIGHT BORDER
 041F7  16887     0700
 041F8  16888 14020001 RTBRDR  LDA     1,M
 041FA  16890 C4604114         LOR     SCNBUF-2,12
 041FC  16892 3C604114         STA     SCNBUF-2,12  INSERT A RIGHT BORDER
                                *TEST TO DETERMINE IF A HORIZ GRID LINE IS REQUIRED
 041FE  16894 5C120000         LDX     2,0,M
 04200  16896 6C6A0001         IMP     13,1,M
 04202  16898 24694110         ICL     13,VSPACE
 04204  16900 6004             JU      HGRID
 04205  16901     0700
 04206  16902 6018             JU      PRNT
                                *A HORIZ GRID LINE IS REQUIRED
 04207  16903     0700
 04208  16904 6C120001 HGRID   IMP     2,1,M
 0420A  16906 640442BC         JS      PRNTLN
 0420C  16908 6C120001         IMP     2,1,M
 0420E  16910 24114108         ICL     2,MAG
 04210  16912 6004             JU      TST5
 04211  16913     0700
 04212  16914 6088             JU      HGRID+2
 04213  16915     0700
 04214  16916 5C6A0000 TST5    LDX     13,0,M
 04216  16918 64044284         JS      CLRSCN
 04218  16920 64044296         JS      FILBUF
 0421A  16922 640442BC         JS      PRNTLN
 0421C  16924 600C             JU      TST4
                                *A HORIZ GRID LINE IS NOT REQUIRED
 0421D  16925     0700
 0421E  16926 640442BC PRNT    JS      PRNTLN
 04220  16928 6C120001         IMP     2,1,M
 04222  16930 24114108         ICL     2,MAG
 04224  16932 6004             JU      TST4
 04225  16933     0700
 04226  16934 6088             JU      PRNT
                                *
                                *
                                *THE RASTER LINE HAS BEEN OUTPUT TO THE STATOS
 04227  16935     0700
 04228  16936 24431000 TST4    ICL     8,RSTRW,M  END OF SYMBOL MATRIX RASTER?
 0422A  16938 6004             JU      PRNTDN  YES
 0422B  16939     0700
 0422C  16940 6430419E         JU      NXLINE     NO
                                *
                                *
                                *OUTPUTTING OF THE SYMBOL MATRIX IS COMPLETE- DISABLE THE
                                *  STATOS AND RETURN
 0422E  16942 64044242 PRNTDN  JS     RSETLP
 04230  16944 7400949C        RTA     GLBRTN
                                *
                                *
                                *STATOS PRINTER/PLOTTER ROUTINES
                                *
                                *
                                *STATOS ENABLE ROUTINE
 00B20   2848           LPNABL  SETX     0B20
 04232  16946           RLPEBL  BSS      2
 04234  16948 04004232 LPEBL   PTR      RLPEBL
 04236  16950 14020B20         LDA      LPNABL,M  LD THE CNTRL WRD
 04238  16952 4AB1             DOA      22,C,K    OUTPUT TO STATOS
 04239  16953     48B2 LPEBL1  DIA      22        READ THE STATUS WRD
 0423A  16954 8C020006         SAM      6,M       TST LP NOT RDY AND LP BSY
 0423C  16956 74004232         RTA      RLPEBL
 0423E  16958 64304239         JGU      LPEBL1    TST AGAIN
                                *
                                *STATOS SYSTEM RESET
```

```
FOCAP-S V10.03 PAGE   4
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT


306 08000  32768           LPRSET  SETX    8000
307 04240  16960           PRSET   BSS    2
308 04242  16962 04004240 RSETLP  PTR     PRSET
309 04244  16964 14028000          LDA     LPRSET,M  LD RESET CMD WRD
310 04246  16966 4AB1              DOA     22,C,K    SEND TO STATOS
311 04247  16967     0700
311 04248  16968 74004240          RTA     PRSET
312                           *
313                           *STATOS TO RASTER MODE
314 00BE0   3040           LPRSTR  SETX    0BE0
315 0424A  16970           RLPRST  BSS     2
316 0424C  16972 0400424A RSTRMD  PTR     RLPRST
317 0424E  16974 14020BE0          LDA     LPRSTR,M  LD CNTRL WRD
318 04250  16976 4AB1              DOA     22,C,K    SEND TO STATOS
319 04251  16977     48B2 RSTRM1  DIA     22        READ STATUS WRD
320 04252  16978 8C02000C         SAM     12,M      TST LP BSY AND PC BSY
321 04254  16980 7400424A         RTA     RLPRST
322 04256  16982 64304251         JGU     RSTRM1    TST AGAIN
323                           *
324                           *STATOS TOP OF FORM
325 00BB3   2995           LPTOF   SETX    0BB3
326 04258  16984           RTOF    BSS     2
327 0425A  16986 04004258 TOF     PTR     RTOF
328 0425C  16988 14020BB3          LDA     LPTOF,M    LD TOF CMD WRD
329 0425E  16990 4AB1              DOA     22,C,K     SEND TO STATOS
330 0425F  16991     48B2 TOF1    DIA     22         TST LP BSY AND PC BSY
331 04260  16992 8C02000C         SAM     12,M       TST LP BSY AND PC BSY
332 04262  16994 74004258         RTA     RTOF
333 04264  16996 6430425F         JGU     TOF1       TST AGAIN
334                           *
335                           *ROUTINE TO SYNC THE SCAN LINE PTR
336 00BA2   2978           SYNCLN  SETX    0BA2
337 04266  16998           RSYNC   BSS     2
338 04268  17000 04004266 SYNC    PTR     RSYNC
339 0426A  17002 14020BA2          LDA     SYNCLN,M   LD SYNC CMD WRD
340 0426C  17004 4AB1              DOA     22,C,K     SEND TO STATOS
341 0426D  17005     48B2 SYNC1   DIA     22         READ THE STATUS WRD
342 0426E  17006 8C02000C         SAM     12,M       TST LP BSY AND PC BSY
343 04270  17008 74004266         RTA     RSYNC
344 04272  17010 6430426D         JGU     SYNC1      TST AGAIN
345                           *
346                           *STATOS SYNC/STEP ROUTINE
347 00B23   2851           LPSTEP  SETX    0B23
348 04274  17012           RSTEPS  BSS     2
349 04276  17014 04004274 STEPS   PTR     RSTEPS
350 04278  17016 14020B23          LDA     LPSTEP,M  LD SYNC/STEP CMD WRD
351 0427A  17018 4AB1              DOA     22,C,K     SEND TO STATOS
352 0427B  17019     48B2 STEPS1  DIA     22         READ THE STATUS WRD
353 0427C  17020 8C02000C         SAM     12,M       TST LP BSY AND PC BSY
354 0427E  17022 74004274         RTA     RSTEPS
355 04280  17024 6430427B         JGU     STEPS1     TST AGAIN
356                           *
357                           *ROUTINE TO CLEAR THE SCAN LINE BUFFER (44 FULL WRDS)
358 04282  17026           RCLRSN  BSS     2
359 04284  17028 04004282 CLRSCN  PTR     RCLRSN
360 04286  17030 14020000          LDA     0,M
361 04288  17032 06E0              LXA     12
362 04289  17033     0700
362 0428A  17034 3C604116 CLRNX   STA     SCNBUF,12  CLR NX WRD
363 0428C  17036 6C620002         IMP     12,2,M
364 0428E  17038 24630058         ICL     12,88,M
365 04290  17040 74004282         RTA     RCLRSN
366 04292  17042 6430428A         JGU     CLRNX      CLR NEXT WRD
```

```
LINE  ABS. ADDRESS INSTCODE SOURCE STATEMENT

367                          *
368                          *ROUTINE TO FILL THE SCAN LINE BUFFER
369                          * FOR THE TOP AND BOTTOM BORDER
370 04294  17044            RFILBF  BSS     2
371 04296  17046 04004294 FILBUF  PTR     RFILBF
372 04298  17048 50620000         LDX     12,0,M
373 0429A  17050 14009486         LDA     ONES
374 0429C  17052 30604116 FILBF1  STA     SCNBUF,12
375 0429E  17054 60620002         IMP     12,2,M
376 042A0  17056 24614112         ICL     12,WPLXMG
377 042A2  17058 74004294         RTA     RFILBF
378 042A4  17060 6430429C         JGU     FILBF1
379                          *
380                          *ROUTINE TO INSERT VERTICAL GRID LINES
381 042A6  17062            RVGRID  BSS     2
382 042A8  17064 040042A6 VGRID   PTR     RVGRID
383 042AA  17066 50620000         LDX     12,0,M
384 042AC  17068 14009444         LDA     BMSK1
385 042AE  17070 30604116 VGRID1  STA     SCNBUF,12
386 042B0  17072 6060410E         IMP     12,HSPACE
387 042B2  17074 24614112         ICL     12,WPLXMG
388 042B4  17076 740042A6         RTA     RVGRID
389 042B6  17078 643042AE         JGU     VGRID1
390                          *
391                          *ROUTINE TO OUTPUT A SINGLE LINE TO THE STATOS USING DMA
392                          *  FOR 44 FULL WRDS
393 00600   1536             DMASTRT SETX    0600
394 042B8  17080            RPRNTL  BSS     2
395 042BA  17082 FD300000 WCCMP   HEX     FD300000 -1'S COMP OF 44 PLACED IN BITS 20-31
396 042BC  17084 040042B8 PRNTLN  PTR     RPRNTL
397 042BE  17086 34004116 DMASET  LAE     SCNBUF  LD STRTING ADDR
398 042C0  17088 0C41             SRA     1  COMPUTE FULL WRD ADDR
399 042C1  17089     0700
399 042C2  17090 C40042BA         LOR     WCCMP   INSRT 1'S COMP OF WRD CNT
400 042C4  17092 48B1             DOA     22,K    SEND TO STATOS
401 042C5  17093     48B2 DMA1    DIA     22
402 042C6  17094 80020000         SAM     12,M  TST LP BSY AND PC BSY
403 042C8  17096 6004             JU      STRTDM  GO TO DMA STRT
403 042C9  17097     0700
404 042CA  17098 6085             JU      DMA1  TST AGAIN
405 042CB  17099     0700
405 042CC  17100 14020800 STRTDM  LDA     DMASTRT,M
406 042CE  17102 4AB1             DOA     22,C,K  SEND TO STATOS
407 042CF  17103     48B2 STRTD1  DIA     22
408 042D0  17104 80020004         SAM     4,M  TST LP BSY
409 042D2  17106 6003             JU      EBLINT
409 042D3  17107     0700
410 042D4  17108 6085             JU      STRTD1
411 042D5  17109     0080 EBLINT  EMI             ENABLE MEMORY INTERRUPT
412 042D6  17110 48B2             DIA     22
413 042D7  17111     0700
413 042D8  17112 80020001         SAM     1,M  TST FOR WCZ
414 042DA  17114 6084             JU      *-4
414 042DB  17115     0700
415 042DC  17116 64044276         JS      STEPS  DO A SYNC/STEP
416 042DE  17118 740042B8         RTA     RPRNTL
417                              END

  0 ERRORS
```


END
12-78